

Program & Abstracts

Conference «Graubünden forscht – Young Scientists in Contest»
September 12–13, 2012 · Davos Congress Center, Entrance «Promenade Nord», Promenade 92, Davos, Switzerland

Guest institutions: alpS Innsbruck, European Academy of Bozen/ Bolzano, Free University of Bozen/Bolzano



Welcome

Academia Rætica welcomes you to its third conference "Graubünden forscht – Young Scientists in Contest". The highly competitive and productive member institutions of Academia Rætica perform internationally recognized research, some of them since more than 100 years. The Canton of Grisons has recognized the academic and economic importance of research and education and is currently in the process of establishing a new legal basis in order to further strengthen these activities.

The neighboring regions of the Grisons, Tyrol and South Tyrol share many of the opportunities and challenges related to the location of their research institutions in an alpine peripheral region. Academia Rætica therefore has invited institutions from these regions to share their experiences.

Academia Rætica has the following aims with this conference: 1) to provide a forum for scientific exchange among researchers from the institutions in the different regions, 2) to stimulate collaboration between the institutions within and beyond these regions, and 3) to inform industry, politics, and the public about the ongoing scientific activities within these regions. The awards will document the best oral and poster presentations. We sincerely thank our sponsors, the keynote and symposium speakers, the authors, chairpersons, reviewers and staff for their guidance, contributions and work. We wish all participants a fruitful and stimulating conference.



Markus Furrer
President Academia Rætica

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Program

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	Michel, Hans Peter	Gemeinde Davos		
	Witte, Barbara	Ärzteverein Davos		
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ORAL PRESENTATIONS

1

Forschung und Wirtschaft

Wasescha Luzius

Botschafter, Genf, Schweiz

Forschung und Wirtschaft bedingen sich gegenseitig, aber nicht alle Forschung ist wirtschaftlich und nicht alle Wirtschaft baut auf Forschung. Die Resultate der Forschung sind entweder Entdeckungen, dann sind sie allgemeines Gut, oder sie sind Erfindungen und gehören dann dem Inhaber von Rechten des geistigen Eigentums. Daraus ergeben sich einige Spannungsfelder. Während die Grundlagenforscher eher entdeckungsorientiert sind, sind die anwendungsorientierten Forscher auf der Suche nach Erfindungen. Dies führt zu einem Spannungsfeld zwischen dem Staat und der Wirtschaft im Forschungsbereich. Die Forschung und die Entwicklung waren institutionell auf Bundesebene von der Wirtschaft getrennt. Mit der Reform der Departemente werden sie ab 1. Januar 2013 in einem Departement vereint. Weitere Spannungsfelder entstehen durch nationale und internationale Forschungsschwerpunkte, z.B. die Zusammenarbeit mit der Europäischen Union, zwischen nationalen und kantonalen Forschungsprioritäten, sowie durch das Spannungsfeld zentrale oder dezentrale Forschung. Die zentrale Forschung liegt im Trend. Es ist demzufolge an den Akteuren in einer Region, sich zusammenzuschliessen, um eine stärkere Position zu erlangen. Neben den Forschungszentren Zürich, Basel, Bern und dem Arc Lémanique verfügen auch andere Regionen wie Graubünden in spezifischen Bereichen über Spitzenforschung. Es sollte das Ziel einer schweizerischen Forschungspolitik sein, die geografischen, wirtschaftlichen und wissenschaftlichen Zielsetzungen zu vereinen.

Da dieser Kongress in Davos stattfindet, am Tor des Parc Elas, werden auch einige konkrete Beispiele aus diesem Naturpark dargestellt, die sowohl wirtschaftlich wie forschungspolitisch von Bedeutung sein könnten.

2

Academia Raetica – Activities and Achievements

Furrer Markus

Academia Raetica, Davos, Switzerland

Academia Raetica is a platform organisation for university-level research and education in the region of the Grisons. It currently consists of 20 associated institutions (medical, technical and natural sciences, humanities), 5 partner institutions and personal members. Its institutional members are organizations with nationally or internationally recognized excellence. Academia Raetica was founded in 2006 as an incorporated association with offices located in Davos and a board consisting of heads from the institutional members. It currently includes about 500 collaborators in the scientific and about 1'500 collaborators in the clinical research institutions. The annual budget of its institutions exceeds CHF 380 Mio. The institutions produce more than 800 publications and organize scientific meetings for more than 3'500 participants each year. Research areas include health, environment and culture.

The purpose of Academia Raetica is to promote research and education in the Canton of the Grisons, to foster internal and external collaboration with its institutions, to raise awareness of government, politicians and the public regarding important issues in research and education, to act as a hinge between the research and development needs of industry, and to provide services. Academia Raetica currently has the following activities: It summarizes the needs of the local research community to support the process of establishing a new cantonal law for research and education at university level, it organizes regular conferences and events to discuss current scientific issues, controversies or results, it regularly publishes attractive research results to demonstrate the scientific achievements obtained, and it works towards the development of the Graduate Campus Davos Graubünden, which will serve all doctoral and post-doctoral researchers in the region. The Graduate Campus is based on the collaboration with ETH Zürich and the University of Zurich and will raise the attractiveness of the region for qualified scientists.

3

New solutions for rapid quantification of IgE specific antibodies: Applications to the mouse model

Huitema Carly, Schawaller Manfred, Rhyner Claudio, Cramer Reto
Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland

When using mouse models to study allergy and asthma it is important to quantitate allergen-specific IgE. Enzyme-linked immunosorbent assay (ELISA) is a simple method used to measure specific IgE, although results still take several hours to generate. Determining the amount of specific IgE is routinely used to assist in allergy diagnosis and in research as a marker for allergic disease. Specific IgE quantification is also relevant when mouse models are used to study asthma and allergy. Frequently the allergen Ovalbumin (OVA), derived from chicken egg is used to immunize mice and the concentration of OVA specific IgE is an important criterion for monitoring the development of allergic complications, including asthma, in this *in vivo* experimental model. However, in common immunization procedures, large amounts of OVA specific IgG is also generated which could potentially interfere with IgE quantification. There are currently two wide-spread, commercially available ELISA-based methods for measuring OVA specific IgE, antigen-capture using an OVA coating and anti-IgE capture with detection using labelled OVA. Here we demonstrate problems with the antigen-capture method specifically related to poor recovery due to interference from OVA-specific IgG present in serum samples. Furthermore, as an improvement on ELISA methods, we have developed new instrumentation based on real time Total Internal Reflection Fluorimetry, which allows rapid quantification of antigen specific IgE based on IgE capture. Using this new system, time-to-result is less than fifteen minutes and the method uses less mouse serum than ELISA.

4

Effect of IL-1 β during proliferation and differentiation of human MSCs

Loebel Claudia, Staudacher Judith, Czekanska Ewa, Alini Mauro, Stoddart Martin
AO Research Institute, Davos, Switzerland

Aim: Inflammation is a key process involved in fracture healing during which many local and systemic regulatory factors that aid in efficient tissue repair are released. One of these factors, IL-1 β has a bimodal expression pattern with peaks during the initial inflammation stage and also remodelling phase of endochondral fracture repair. In this context, the aim of the study was to determine the effects of IL-1 β on differentiation and mineralization in human mesenchymal stem cells (MSCs).

Furthermore, we also investigated the impact of IL-1 β on different MSC culture systems (monolayer versus micromass).

Methods: Bone marrow derived human MSCs from four different donors were cultured either in micromass or monolayer over a period of 28 days. During this time, the MSCs were cultured in osteogenic medium (10⁻⁷ M dexamethasone, 5 mM β -glycerol phosphate and 50 μ g/ml ascorbic acid) with or without IL-1 β (10ng/ml) supplementation. DNA content, alkaline phosphatase (ALP) activity, alizarin-red S quantification, Ca⁴⁵-Incorporation and expression of osteogenic specific genes were assessed.

Key findings: Human MSCs treated with IL-1 β and osteogenic induction showed an increased rate of proliferation between day 7 and day 21 of cell culture. A biphasic effect in ALP-activity was observed in both, micromass and IL-1 β treated monolayer, cultures. This effect was further demonstrated in the assessment of early and late osteogenic specific markers.

These findings suggest that the addition of IL-1 β can enhance proliferation and differentiation potential of human MSCs *in vitro*. It remains to be proven, that treatment with IL-1 β induces a second peak in ALP-activity due to increased cell proliferation, as this was not determined at the set time points.

Ongoing studies investigate whether a shorter application of IL-1 β would induce the same effect as seen in long-term cultures. This would be beneficial for the fracture treatment within the operating theatre and other clinical applications.

5

Histamine 2 receptor activation reduces allergic airway inflammation in mice

Ferstl Ruth, Ziegler Mario, Frei Remo, Konieczna Patrycja, Akdis Cezmi, O'Mahony Liam
Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland

Greater than 15% of people in the western population suffer from allergy or asthma. In order to develop new and more effective therapies, a better understanding of the molecular mechanisms underpinning this chronic disease is required. Histamine, released by activated mast cells and immune cells, causes many of the symptoms associated with allergy and asthma. Histamine is recognized by four different Histamine receptors (H1R-H4R), each inducing its own signaling cascade. H2R is recognized as an immune regulatory receptor but its role in allergy is not well described. The aim of this study was to investigate the role of H2R in a murine model of allergic airway inflammation (AAI). Female H2R^{-/-} mice and BALB/c wild-type mice were sensitized i.p. and OVA-aerosol challenged. Mice lacking H2R showed significant increased cell numbers in bronchoalveolar lavages, mainly due to elevated eosinophil numbers. Lung histology confirmed increased inflammatory scores in knockout animals. Furthermore, in vitro re-stimulation with OVA induced higher Th1 and Th2 cytokine release from single cell suspensions from lungs and spleen. All together, H2R^{-/-} mice develop more severe allergic airway inflammation. CD4⁺CD25⁺Foxp3⁺ Treg numbers were evaluated by flow cytometry in Peyer's patch, mesenteric lymph nodes, spleen, lung-draining lymph nodes, lung tissue and bronchoalveolar lavages. Treg numbers were similar in wt and knockout animals at all sites, with a tendency towards increased Treg numbers in H2R^{-/-} inflamed lungs, perhaps related to altered anti-inflammatory compensatory mechanisms in the H2R^{-/-} animals. In conclusion, H2R is an important immunoregulatory receptor that influences the severity of allergic airway inflammation in murine models. In addition, the increased severity of disease was not associated with decreased Treg numbers suggesting that other immune cell populations may be directly influenced by histamine signaling through the H2R.

6

Cartilage tissue engineering

Gardner Oliver F.W.^{1,2}, Archer Charles W.², Alini Mauro¹, Stoddart Martin J.¹

¹ AO Research Institute, Davos, Switzerland

² Cardiff School of Biosciences, Cardiff, United Kingdom

Introduction: The repair of damaged cartilage has, until recently, been carried out using surgical stimulation techniques. Newer cell based techniques aim to improve the quality of repair that can be achieved in cartilage lesions. One of the types of cell being considered for these therapies are mesenchymal stem cells (MSCs), found in the bone marrow. By encouraging cellular development, these cells can be made to produce cartilage. This process however causes the cells to develop further into a stage called hypertrophy. Hypertrophic cells produce markers associated with bone such as type X collagen. We aim to prevent hypertrophy by mimicking the natural scenario seen in lengthening bones, where hypertrophic cells maintain the production of cartilage markers in less developed cells.

Methods: MSCs are seeded into polyurethane scaffold and then cultured in growth medium containing a growth factor called TGF- β , this encourages the cells to develop into cartilage producing cells and then over time into hypertrophic cells. After one week a scaffold containing fresh MSCs is placed on top of the original scaffold. This positioning of less developed cells on top of hypertrophic cells reflects the cellular organisation within lengthening bones. The constructs are then cultured for two weeks before having their gene expression and production of cartilage components analysed.

Results: Our results so far suggest an increase in the important cartilage molecules type II collagen and aggrecan in the top scaffolds.

Discussion: The data collected so far suggests that the culture of cartilage producing MSCs on top of hypertrophic cells slows the progression of these less developed cells in the bottom scaffolds towards hypertrophy. As a result there is an increase in the production of the cartilage markers type II collagen and aggrecan. Further work is needed to fully access the effects of co-culturing these cells under various conditions.

7

Cocaine induces a reversible stomatocytosis of red blood cells, increases blood viscosity, and inhibits platelet aggregation in vitro

Cagienard Flavio¹, Schulzki Thomas², Reinhart Walter H.¹

¹ Department of Internal Medicine, Kantonsspital Graubünden, Chur, Switzerland

² Department of Internal Medicine, Division of Transfusion Medicine, Kantonsspital Graubünden, Chur, Switzerland

Background: Severe side effects of cocaine are vasoocclusive events such as myocardial infarction and stroke. We have hypothesized that cocaine could affect red blood cells (RBCs) and platelet.

Methods: Blood from healthy volunteers (adjusted hematocrit 45%) was incubated with increasing cocaine concentrations: 0, 10, 100, 1000 and 10'000 $\mu\text{mol/L}$ plasma. RBCs were fixed in 1% glutaraldehyde for morphological analysis. Blood viscosity was measured with a Couette Viscometer (Contraves LS 30) at 37°C and a shear rate of 69.5 s⁻¹. RBC aggregation was assessed with a Myrenne aggregometer. Platelet aggregation with the above mentioned cocaine concentrations was measured in whole blood either under high shear flow (PFA-100 instrument, Siemens) or under stirring conditions (Aggregometer Model 700, Chrono-Log Corp.). The latter instrument was also used to measure platelet aggregation in platelet rich plasma.

Results: Cocaine induced a dose- and time-dependent stomatocytic shape transformation of RBCs. Stomatocytosis was reversible by resuspension of the RBCs in cocaine-free buffer. This stomatocytic shape change increased whole blood viscosity at high shear rate, whereas RBC aggregation was not affected. Platelet aggregation was inhibited by cocaine concentrations \rightarrow 1000 $\mu\text{mol/L}$ with all 3 modes of measurement.

Discussion and Conclusions: Stomatocytosis indicates a preferential intercalation of cocaine in the inner half of the membrane lipid bilayer (bilayer couple theory of Sheetz and Singer). Stomatocytosis increased blood viscosity, but did not affect RBC aggregation. Platelet aggregation was inhibited by cocaine, which makes it very unlikely that platelet activation plays a role in vascular occlusions after cocaine consumption. These effects occurred at cocaine concentrations which were several-fold above those measured in vivo. Therefore, it is unlikely that hemorheological factors are involved in vascular events after cocaine consumption.

8

Locking compression plate fixation for supracondylar peri-prosthetic fracture of the distal femur after total knee arthroplasty

Michelitsch Christian, Stoffel Karl, Müller Thomas, Sommer Christoph

Department of Surgery, Kantonsspital Graubünden, Chur, Switzerland

Introduction: New locked plate devices offer theoretical advantages for the treatment of supracondylar femur fractures associated with total knee arthroplasty. Crucial for treatment is to distinguish fractures above the femoral component, which remains firmly fixed, from those involving the TKA and component loosening. Supracondylar periprosthetic fractures are almost always managed surgically. Conventional plating was often associated with secondary instability due to poor bone stock and critically distal fracture extension. New locked plate devices improve fixation in osteoporotic bone and can be inserted minimally invasive. We present a continuous series of distal femoral fractures after knee arthroplasty treated with a locked plate designed for the distal femur.

Material and Methods: From June 2004 to April 2011 seventeen adult patients with eighteen supracondylar femur fractures above a well-fixed TKA were treated with a locked plate (LCP-DF, Synthes) in a MIPO-technique. No initial bone graft was used. Rehabilitation protocol consisted in immediate mobilisation with partial weight bearing whenever possible.

Results: Six patients were lost for the follow-up (three living abroad, three who died in the meantime). Eleven patients with twelve fractures (Average age 71.8 years) were available for follow-up at an average of 7.5 months. According to the Rorabeck classification, there were eleven Type II and one Type I fractures. Eleven fractures were closed and one was an 1° open. Eleven of the twelve fractures healed. One developed an aseptic delayed union due to a distal fixation loss. Reosteosynthesis with cement augmentation, bone grafting and additional medial plate was successful. No infectious complication was reported and all knee prosthesis remained stable at follow-up.

Discussion: Fixation of periprosthetic supracondylar femur fractures with a locked plate is an efficient method with high stability for early motion and immediate mobilisation even in osteoporotic bone. Minimal invasive techniques are optimal for preservation of the vascularity of the fracture zone.

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High altitude research: A new methodology for non-invasive investigations on the effects of hypobaric hypoxia

Strapazzon Giacomo¹, Lochner Piergiorgio², Hofer Georg³, Fop Ernst⁴, Procter Emily¹, Brugger Hermann¹

¹ Institute of Mountain Emergency Medicine, European Academy of Bozen/Bolzano (EURAC) Bolzano, Italy

² Department of Neurology, General Hospital of Merano, Merano, Italy

³ Department of Anaesthesiology and Critical Care Medicine, General Hospital of Silandro, Silandro, Italy

⁴ Department of Anaesthesiology and Critical Care Medicine, General Hospital of Bolzano, Bolzano, Italy

Millions of people travel annually to high altitudes for recreational and occupational purposes. At an altitude of 2200 m ca. 6.9% of people are affected by high-altitude diseases and 38% at 3500 m, and the consequences can be fatal. Currently, no valuable method exists for early diagnosis or instrumental monitoring of high-altitude diseases in a pre-hospital setting.

Data collection at high altitude is not without logistical, technical and ethical challenges, and standardized and reproducible data on high-altitude diseases are often lacking due to different patterns of acclimatization between studies and other confounding factors. The aim of the study was to investigate the effects of hypobaric hypoxia on lung, optic nerve and hydration status in a group of 21 healthy subjects using non-invasive diagnostic devices.

A modified "three Rs" approach, derived from Russel and Burch's guiding principles for the use of animals in research, was used to develop a new methodology for high altitude research: replacement of invasive with non-invasive methods, reduction of the number of subjects exposed and refinement of the experimental design to enhance data reliability. Furthermore, safety and risk management were considered essential study components.

A longitudinal profile of the subjects was made during acute (3, 9, 24 and 48 hours), subacute (72 hours) and chronic (1 week) exposure to hypobaric hypoxia at 4000 m without physical effort. Medical and laboratory equipment was tested before and during exposure to altitude and cold in accordance with manufacturer guidelines to guarantee data quality. An emergency treatment and evacuation plan was created in collaboration with the emergency medical system and mountain rescue service to account for risks associated with the inaccessibility of the study site.

Results offered both reliable scientific data and a new model to perform studies and guarantee safety in pre-hospital research.

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What is the role of 'nonorganic-somatic-components' in functional capacity evaluations in patients with chronic non-specific low back pain undergoing fitness for work evaluation?

Oesch Peter^{1,2}, Meyer Kathrin⁵, Janssen Beatrix⁴, Mowinckel Peter⁶, Bachmann Stefan^{1,2,3}, Hagen Kare Birger^{6,7}

¹ Research Department, Rehabilitation Centre Valens, Valens, Switzerland

² Department of Rheumatology, Rehabilitation Centre Valens, Valens, Switzerland

³ Department of Geriatrics, Inselspital, Bern University Hospital, Bern, Switzerland

⁴ Department of Work Rehabilitation, SUVA Clinic Bellikon, Bellikon, Switzerland

⁵ Department of Rheumatology and Institute for Physical Medicine, Zurich University Hospital, Zurich, Switzerland

⁶ National Resource Centre for Rehabilitation in Rheumatology, Diakonhjemmet Hospital, Oslo, Norway

⁷ Institute of Health and Society, Department of Health Sciences, University of Oslo Norway, Oslo, Norway

Background: Low back pain (LBP) continues to be a major health problem causing personal suffering and enormous socioeconomic costs. Most of the patients suffer from nonspecific LBP (NSLBP), defined as not attributable to a recognisable known specific pathology. Functional Capacity Evaluation (FCE) is increasingly used for physical fitness-for-work evaluation in patients with chronic NSLBP, but results seem to be influenced by physical as well as psychosocial factors. The influence of 'nonorganic-somatic-components' together with physical and other psychosocial factors on FCE performance has not yet been investigated.

Objective: To assess the association of 'nonorganic-somatic-components' together with physical and other psychosocial factors on FCE in patients with chronic NSLBP undergoing fitness-for-work evaluation.

Methods: Analytical cross-sectional study including 126 patients with chronic NSLBP referred for physical fitness-for-work evaluation was performed. FCE tests were lifting from floor to waist; forward bend standing; grip strength; and six minute walking. 'Nonorganic-somatic-components' were assessed with the eight 'nonorganic-somatic-signs' as defined by Waddell, and were adjusted for age, gender, days off work, salary in the previous occupation, pain intensity, fear avoidance belief, and perceived functional ability in multivariate regression analyses.

Results: Between 42%–58% of the variation in the FCE tests was explained in the final multivariate regression models. 'Nonorganic-somatic-components' were consistent independent predictors for all tests. Their influence was most important on forward bend standing and walking distance, and less on grip strength and lifting performance. The physical factors of age and/or gender were strongly associated with grip strength and lifting, less with walking distance and not at all with forward bend standing. The influence of at least one other psychosocial factor was observed in all FCE tests, having the highest proportion in the six minute walking test.

Conclusions: 'Nonorganic-somatic-components' seem to be consistent independent predictors in FCE testing and should be considered for interpretation of test results.

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alpS-Centre for Climate Change and Adaptation Technologies: Its vision, mission, and current activities

Stötter Johann

alpS GmbH, Innsbruck, Austria

Succeeding the original alpS-Centre for Natural Hazard and Risk Management, the present alpS-Centre for Climate Change Adaptation Technologies was founded in 2010. Assuming that Global Climate Change impacts every sphere of society, every environmental niche, touches every region of the globe, it can be expected that it will reshape human-environment systems as never experienced before. Because it is a fact that mountain regions are particularly vulnerable and disproportionately affected by this change, the philosophy of alpS was developed.

The alps philosophy is based on seven fundamental premises, which constitute the factual background of the alpS research strategy. Following its philosophy alpS not only aims at minimizing negative effects of global climate change, but also at seizing the opportunities for innovation and development that come along. Applying an open risk-management approach in all its endeavours, be it energy, risk consulting, or climate adaptation research, alpS maintains a positive and optimistic outlook on the future. We believe that by adhering to principles of sustainability, by building capacities to adapt, by developing appropriate technologies and strategies, and by effectively managing our risk, alpS will contribute to the protection and development of mountain regions around the world. Thus the vision of alpS is to "Inspire and drive sustainability in mountain regions".

The alpS vision statement captures the collective values, logic, and goals of the centre. It represents the essence of its striving and informs the running and strategic planning of the organisation as well as its public representation and marketing message. Therefore the following mission statements are derived:

- alpS will become a leading research institution for climate change adaptation in mountain regions
- alpS will spearhead innovative adaptation technologies and strategies to open economic opportunities
- alpS will create and strengthen adaptation capacities, reduce vulnerabilities, inspire social change, and live sustainability
- alpS will inform and help implement climate change adaptation policy in mountain regions

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Rainfall runoff modelling in a tributary catchment of the river Inn, Tyrol, for implementation in the flood forecasting system HoPI – a case study

Kerl Florian¹, Schneider Katrin², Bellinger Johannes^{2,3}, Schöber Johannes^{2,3}, Achleitner Stefan³, Schöberl Friedrich¹, Kirnbauer Robert⁴

¹ Institute of Geography, University of Innsbruck, Austria

² alpS GmbH-Center for Climate Change Adaptation Technologies-, Innsbruck, Austria

³ Unit of Hydraulic Engineering, University of Innsbruck, Austria

⁴ Institute of Hydraulic Engineering and Water Resources Management, Vienna University of Technology, Austria

Flood-forecasting can help to reduce vulnerability due to flood-events. Especially densely settled mountain areas entail a high hazard potential. To provide a tool for flood-forecasting for the Inn river catchment in Tyrol, the HoPI system (Hochwasserprognose-system Inn) was developed. This system consists of a coupled hydraulic/hydrological model for the Tyrolean part of the river Inn. HoPI simulates discharge of the tributaries to the river Inn and the channel hydraulic of the river Inn. The hydrological simulations are based on either observed meteorological data or on meteorological forecasts of the INCA (Integrated Nowcasting through Comprehensive Analysis) model of the ZAMG (ZentralAnstalt für Meteorologie und Geodynamik). The forecast horizon for the discharge simulations is 48h. As a result, flood warnings can be communicated early to improve risk management.

In this case study, the hydrological subsystem and the pre-processing of the data is presented. The study region is a tributary catchment of the river Inn, Tyrol. The sub-catchment is modelled with the semi-distributed hydrological model HQsim based on hydrological response units (HRU). For each HRU, information like slope, aspect, soil type, flow time to the channel and meteorological input is investigated. Based on the catchment characteristics and on meteorological data, HQsim models the runoff in two steps. First, the runoff generation is modelled, separating three flow components (surface-, subsurface- and baseflow) for each HRU. Subsequently these flow components are routed to the channel and through the channel to the basin outlet. Simulated discharge is compared to measured discharge at the gauge. During the process of calibration, specific parameters of the HRU (e.g. hydraulic conductivity and soil depth) are changed to fit the simulated data to the observed data. The best parameter setting, selected on the basis of statistic parameters like Nash-Sutcliffe-Efficiency, time delay of peak-flow or BIAS, is then incorporated into the HoPI system.

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Potential impacts of climate change on snow avalanches starting in forested terrain

Teich Michaela^{1,2}, Bartelt Perry¹, Grêt-Regamey Adrienne², Marty Christoph¹, Ulrich Melanie^{1,3}, Zurbriggen Natalie^{4,5}, Bebi Peter¹

¹ WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

² Planning of Landscape and Urban Systems PLUS, Swiss Federal Institute of Technology ETH, Zurich, Switzerland

³ Institute of Natural Resources Sciences, Zurich University of Applied Sciences ZHAW, Waedenswil, Switzerland

⁴ Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland

⁵ Forest Ecology, Institute of Terrestrial Ecosystems, Swiss Federal Institute of Technology ETH, Zurich, Switzerland

Mountain forests play a crucial role in avalanche control by modifying the snow's mechanical properties. However, snow avalanches do occur in forests due to unfavorable combinations of site, snow and weather conditions and these so-called 'forest avalanches' can pose hazard to recreationists, human settlements and infrastructure. Under climate change, the frequency and magnitude of forest avalanches are likely to be affected by changing snow regimes and meteorological conditions as well as by changes in forest structure.

We present a comprehensive overview of new findings in forest avalanche research from the Swiss Alps and discuss their relevance in the context of global warming. We applied a logistic trend analysis over 41 years based on data of 14 snow and weather stations to analyze past changes in the occurrence of snow and weather conditions which are associated with forest avalanche releases. We distinguished between characteristic situations for (1) 'new snow forest avalanches' and (2) 'old snow forest avalanches' by applying a hierarchical clustering technique based on 189 observed forest avalanche events. Both combinations of favorable snow and weather conditions show decreasing trends which suggest a further decrease of such conditions under current climate change. Repeated measurements of forest parameters in avalanche starting zones revealed an increase in density of small trees (<15 cm) over the last 20-25 years. We found that higher densities of small-diameter trees in the starting zone of forest avalanches significantly reduced their runout distance which leads to the hypothesis that the destructive potential of such avalanches will be reduced in the future. In the absence of large scale forest disturbances such as fires and bark beetle outbreaks, it is thus likely that avalanches in forests of the European Alps will be less frequent in the future due to both fewer events and changes in forest structure.

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Public empowerment policies for crisis management – Policy needs and research gaps

Stal Marc¹, Vos Marita²

¹ Global Risk Forum GRF Davos, Davos, Switzerland

² University of Jyväskylä, Department of Communication, Jyväskylä, Finland

A general goal of crisis management is prevention and reduction of harm or damage. This is supported by the communication goals set for citizens: empowerment to act, social understanding of risks and increased cooperation. The role of communities in crisis response can be enhanced, while human technology can support preparedness training and the issuing of instructions in crisis situations. By investigating best practices in educating citizens and working with communities, taking their point of view into account, potential key enablers for public empowerment can be identified and analysed. Public Empowerment Policies enhance crisis management as a coproduction of response organizations and citizens.

The "Public Empowerment Policies for crisis management" PEP Project is a 3 year (January 2012 – December 2014) EC funded FP7 project. The aim of the PEP project is to investigate how the crisis response abilities of the public can be enhanced and to clarify what public empowerment policies and research priorities can

further these objectives. The project will identify best practices in the community approach to crisis resilience and give directions for future research and implementation, including the use of social media and mobile services, to further citizen response. The input of the experts in the field of crisis management and communication is a key element in pursuing the goals of the PEP project. The presentation will provide an overview about crisis management and crisis communication, highlighting policy needs and research gaps in these areas. Additionally, up to date research results of the PEP project will be presented.

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Motorradreisende am Ofenpass: Wahrnehmung des Ofenpasses und des Schweizerischen Nationalparks aus Sicht der Motorradreisenden

Jauss Andrea¹, Backhaus Norman¹, Filli Flurin²

¹ Geographisches Institut der Universität Zürich, Abteilung Humangeographie, Zürich, Schweiz

² Schweizerischer Nationalpark, Zerne, Schweiz

Das Biosphärenreservat Val Müstair Parc Naziunal ist ein attraktiver Tourismusstandort und wird über die Ofenbergstrasse, welche durch den Schweizerischen Nationalpark ins Münstertal und bis zur schweizerisch-italienischen Grenze führt, erschlossen. Neben der Erschliessung des Nationalparks und des Münstertals dient sie für den Reise- und Güterverkehr als Transit ins Ausland. Aufgrund dieser vielfältigen Nutzung begegnen sich am Ofenpass Anspruchsgruppen mit unterschiedlichen Erwartungen an diese Region. Auf dem Gelände des Nationalparks und in den Dörfern des Münstertals, wird der zunehmende Verkehr zur Belastung. Neben Stimmen aus der Bevölkerung zeigen Besucherbefragungen des Nationalparks, dass Verkehrsstaus, Unfälle und im Besonderen der Motorradlärm negativ auffallen. Die Motorradreisenden tragen als Touristengruppe aber auch zum Regionaleinkommen bei. Der Nationalpark hat sich dem Verkehrsproblem angenommen und möchte die Motorradreisenden besser kennenlernen.

In der vorliegenden Arbeit wird die Perspektive der Motorradreisenden mittels Fragebögen, teilnehmender Beobachtung und Interviews aufgezeigt. Sowohl der Tourismusbeitrag, die Herkunft, Routenplanung, die Faszination des Motorradfahrens als auch die Wahrnehmung des Schweizerischen Nationalparks werden erhoben. Der Fokus liegt auf dem Problembewusstsein und der Massnahmenbereitschaft von Motorradreisenden. Ziel ist es ein Bild von den Motorradreisenden am Ofenpass zu erhalten, um ihre Sichtweise zur Lösungsfindung heranzuziehen.

Die Ergebnisse zeigen eine heterogene Touristengruppe, welche den Ofenpass als einfache Fahrstrecke in abwechslungsreicher Landschaft schätzt. Er dient als Transit ins Ausland und zu den Pässen in seiner Umgebung. Motorradreisende möchten in erster Linie unterwegs sein und geniessen die Fahrphysik. Der Nationalpark wird auf der Durchreise wahrgenommen, stellt für sie aber kein Reiseziel dar. Die Motorradreisenden sind sich bewusst, dass sich andere Personen am Motorradlärm und dem Fahrverhalten stören und zeigen für verkehrstechnische Massnahmen Verständnis. Es ist ihnen ein Anliegen, dass Massnahmen nicht einseitig zu Lasten einer Fahrzeuggruppe gehen und dass der Zweck einer Kontrolle ersichtlich ist. Als Massnahme wird die Kombination einer Kampagne zum Fahrverhalten im Nationalpark mit Fahrzeugkontrollen und Videoanalysen vorgeschlagen.

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Die Europäische Akademie Bozen (EURAC)

Stuflesser Werner

European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

Die Europäische Akademie Bozen (EURAC) ist ein innovatives Forschungszentrum in Südtirol. Rund 330 Mitarbeiterinnen und Mitarbeiter arbeiten dort in vier Bereichen: Autonomen, Berg, Gesundheit und Technologien mit einem Gesamtbudget von rund 20 Mio. Euro.

Südtirol eignet sich als Berg- und Grenzgebiet in besonderer Weise für die Forschung in diesen Gebieten. So betreuen die Wissen-

schaftler zahlreiche Projekte mit Lokalbezug, die als Modell für die Gestaltung europäischer Regionen herangezogen werden.

Besonderes Kennzeichen der EURAC-Forschung ist die flexible und interdisziplinäre Zusammensetzung der Wissenschaftlerteams, wie zum Beispiel bei Projekten zur Entwicklung von Bergregionen, wo Minderheitenexperten, Soziologen, Wirtschaftsökonomen, Sprachwissenschaftler und Naturwissenschaftler kooperieren. Forschungsprojekte werden so unter verschiedenen Perspektiven und mit innovativen Lösungsansätzen bearbeitet.

Die EURAC finanziert sich zu 52% aus Drittmitteln, 48% erhält sie als Grundfinanzierung durch die Autonome Provinz Bozen-Südtirol. Neben zahlreichen lokalen und nationalen Projekten arbeiten die Wissenschaftler derzeit an 42 EU-Projekten. In den letzten zehn Jahren wurden 90 EU-Projekte mit einer Auftragssumme von fast 20 Millionen Euro abgeschlossen.

Der durchschnittliche EURAC-Mitarbeiter ist weiblich (58% der Mitarbeiter sind Frauen) und 35,6 Jahre alt.

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The Center for Biomedicine: Cutting-edge research with local impact

Pramstaller Peter P.

Center for Biomedicine, European Academy of Bozen/Bolzano (EURAC), Bozen, Italy – Affiliated Institute of the University of Lübeck, Lübeck, Germany.

Healthcare systems are changing globally, and finding ways to incorporate research results into the healthcare service is seen as a necessary way to catalyze the development and progress of such change, ultimately leading towards better and more personalized healthcare. The Center for Biomedicine (CBM) is a newly-founded biomedical research institution of the European Academy (EURAC) working in close partnership with the South Tyrolean Healthcare Service. As such, it is in a unique position to ensure targeted and coordinated health-related research efforts in South Tyrol. In the long term the CBM will be a state of the art biomedical research facility that also acts as a health forum bringing together researchers, clinicians, policy makers, industrial partners and the public, in a unique synergy that will lead to innovative ways to improve population health, locally and beyond.

In order to achieve our vision and execute our mission we will focus on goals within three strategic areas: (i) Building Resources: creating a long-term biomedical research resource and infrastructure for epidemiological, clinical and molecular studies, (ii) Generating Knowledge: investigating the molecular basis of disease, including molecular determinants, biomarkers and mechanisms, and (iii) Impacting Healthcare: developing additional research capacity with the local healthcare service and seeking to translate research knowledge into improved healthcare. We believe that our strategic goals align perfectly with our research philosophy, represented in the biomedical research cycle, in which research begins with people and, following a range of clinical, molecular and translational approaches, ends with real health benefits for the people.

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Sustainability research in mountain regions

Niedrist Georg^{1,2}, Bottarin Roberta¹, Tappeiner Ulrike^{1,2}

¹ Institute for Alpine Environment, European Academy of Bozen/Bolzano (EURAC), Bozen, Italy

² Institute of Ecology, University of Innsbruck, Innsbruck, Austria

Mountain regions are proven to be particularly vulnerable to global change phenomena, i.e. land-use change and climate change. The resulting consequences like biodiversity loss or changing water budgets come along with a growing demand for feasible environmental indicators to measure, evaluate, and communicate trends in sustainability. Such indicators have to meet high requirements, combining scientific accuracy as well as practicability in policy.

The EURAC-Institute for Alpine Environment studies environmental processes and impacts between the priorities of environment, economy and society since 1992. The research focus ranges from detailed process measurements on ecosystem level to landscape

analysis at alpine-wide level. As an example a trans-disciplinary approach from the Vinschgau gets presented, where experimental and modeling activities were combined: Detailed ecosystem processes were measured using automatic lysimeters, sapflow installations and eddy covariance techniques. The obtained results in combination with further, manipulative experiments act as input and validation parameters for a distributed hydrologic model. Long-term objective is an assessment of possible future impacts of an increasing temperature on grassland production and water availability in dry alpine catchments.

However, obtained data are not used for quantifying ecological processes only but they deliver also important inputs for the development of environmental indicators. Best praxis examples show, that they are an efficient tool for quantifying historical changes in landscapes and for comparing municipalities or alpine regions in terms of sustainability.

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Institute of Mountain Emergency Medicine: Bridging the gaps between science, practice, education and public in an emerging field of medicine

Brugger Hermann, Procter Emily, Strapazon Giacomo
Institute of Mountain Emergency Medicine, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

The Institute of Mountain Emergency Medicine was founded in October 2009 as the only research facility in the field of mountain emergency medicine worldwide. The founding mission was to achieve an internationally recognised, evidence-based scientific standard of excellence in the field of mountain emergency medicine through the methodical acquisition of epidemiological and experimental data. In addition, the institute holds a firm commitment to the delivery of educational activities for the continued advancement of both the scientific basis and practical skills in the field. Research interests are all aspects of emergency medicine with a particular focus on the influences of geographic/logistical factors and extreme environmental factors on the pathophysiology [experimental methods], epidemiology [observational] and on-site treatment (position papers) of cold injuries, trauma and other acute illnesses. Recently, an expert consensus defined the most urgent single topics in the field at present as optimal treatment of severe hypothermic patients without cardiac arrest, trauma care, management of cardiovascular emergencies in relation to their incidence and treatment cessation recommendations. The necessity of further experimental studies and collection of data specific to the pre-hospital setting remains the top priority for this field.

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Activities at the EURAC Institute for Applied Remote Sensing

Zebisch Marc
Institute for Applied Remote Sensing, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

We will present "state of the art" remote sensing as a very useful tool for environmental monitoring in a mountain environment. Satellite data today offers a huge range of scales and sensor types from weather satellites to high resolution radar satellites. At the EURAC Institute for Applied Remote Sensing we are working on the fusion of earth observation (EO) techniques with interdisciplinary approaches in environmental research. Building on EURAC's competence in mountain research, our main focus is on regional adapted research, products and services for the Alps, and other mountainous regions in the world. Topics of research include monitoring of snow and glaciers, the water cycle and soil moisture, forests and forest damages, habitats and habitat conservation status, vegetation development and phenology, air quality, landslides, clouds, aerosols and incoming radiation and many others.

Based on this research we are developing a range of EO based products and services for both local and regional applications, both responding to the demands of and in cooperation with authorities and decision makers. Our expertise includes the capacity to use a full range of EO techniques for optical and radar data

processing, analysis and integration, the modelling of biophysical processes (hydrology, natural hazards), and working with climate data and climate scenarios. In addition, we use a range of interdisciplinary concepts for risk and vulnerability assessments. Our own receiving station, located on the Renon peak (2260m) and an EO data centre give us direct access to satellite data and the ability to process them in near real-time.

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Aktivitäten des Instituts für Regionalentwicklung und Standortmanagement

Streifeneder Thomas

Institute for Regional Development and Location Management, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

Die Entwicklungsdynamik von Berggebieten bildet den zentralen Forschungsgegenstand des Instituts für Regionalentwicklung und Standortmanagement. Wirtschafts-, Lebens- und Erlebnisräume werden im Sinne der Nachhaltigkeit analysiert. Erforscht werden die Standortbedingungen, räumliche Auswirkungen des menschlichen Handelns und Fragen der Nachhaltigkeit insbesondere an den Schnittstellen der Bereiche Tourismus, Agrarökonomie, Genossenschaftswesen sowie Verkehr und Mobilität. Das Institut forscht in einer angewandten und interdisziplinären Herangehensweise in einem breiten Netzwerk auf internationaler, nationaler und regionaler Ebene. Ziel ist es, aktiv zu einer nachhaltigen Entwicklung und Gestaltung des territorialen Kapitals von Berggebieten im Sinne vitaler Wirtschafts-, Lebens- und Erlebnisräume beizutragen. Vorgestellt werden ausgewählte Projekte der angewandten und praxisnahen Institutsforschung in Berggebieten mit einem interdisziplinären Forschungsansatz an den Schnittstellen Mensch/Gesellschaft/Umwelt, insbesondere in den Bereichen Agrarökonomie, Raumplanung, Mobilität und Verkehr, Grundlagenforschung in der vergleichenden Raumbearbeitung von Berggebieten und der Analyse der urban/ruralen Wechselbeziehungen und die wirtschaftsgeographische und betriebswirtschaftliche Erforschung der Auswirkungen des menschlichen Handelns, mit dem Ziel der nachhaltigen Entwicklung von Räumen.

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Investigation into the genetic causes of complex diseases in alpine population isolates: the MICROS study

Gögele Martin, Pattaro Cristian, Pichler Irene, Pramstaller Peter P.

Center for Biomedicine, European Academy of Bozen/Bolzano (EURAC), Bozen, Italy - Affiliated Institute of the University of Lübeck, Lübeck, Germany.

In 2002/03, the MICROS study, a population-based survey, was carried out in three side-valleys of the Vinschgau, South Tyrol (Italy). The villages Stilfs, Langtaufers, and Martell were chosen because they exhibit characteristics of so-called microisolates. Microisolates are defined as small founder populations which have experienced over several generations and until recent time negligible immigration and slow population growth. About 1.300 inhabitants of these villages participated in the survey. They underwent clinical examinations, an interview-based screening questionnaire, and provided blood samples for DNA extraction. Personal information of the participants and church records allowed the reconstruction of extended pedigrees back to the 17th century. The MICROS data were used for genome-wide linkage and association studies in order to investigate the genetic causes of complex diseases like restless legs syndrome and genetic determinants of quantitative phenotypes like serum creatinine levels, serum iron levels, and QT intervals. Collaborations were built up both on European level (participation in the EUROSPAN consortium involving five genetically isolated populations) and international level. The participation in numerous international consortia led to highly recognized publications about genetic factors influencing blood pressure, blood lipids, and kidney function. In 2011, a large population-based study, the CHRIS (Cooperative Health Research In South Tyrol) study was started with investiga-

tion focusing on the interaction between genetic factors and environment in cardiovascular, neurological, and metabolic diseases. All adult inhabitants of the Vinschgau are invited to clinical examinations in the CHRIS-study center in Schlanders in 2011–16 with regular follow-ups planned over the next decades.

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The role of orthopaedic implant material choice on the immune response to bacterial contamination

Rochford Edward^{1,2}, O'Mahony Liam³, Poulsson Alexandra¹, Ziegler Mario³, Richards R. Geoff^{1,2}, Moriarty T. Fintan¹

¹ AO Research Institute, AO Foundation, Davos, Switzerland

² IBERS, Aberystwyth University, Aberystwyth, United Kingdom

³ Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland

Introduction: The presence of an implanted material increases infection risk by compromising the immune system¹. In addition, the effect on the immune response to an implant is related to the material used and this may furthermore alter infection risk². In the current study, a range of orthopaedic materials were screened and different aspects of immune system activation quantified in the presence and absence of bacterial contaminants.

Materials and Methods: Materials including titanium, titanium-aluminium-niobium, stainless steel (Synthes, CH), polyetheretherketone (Invibio Biomaterial Solutions) and oxygen plasma modified polyetheretherketone were screened for immunoactivation in the absence and presence of contaminating lipopolysaccharide or adherent *Staphylococcus aureus* bacteria. The activation of the complement cascade was assessed using human serum and a C3a-desArg ELISA. The Quantiblu assay was used with cell-line THP-1 monocytes to identify NF- κ B activation indicative of an inflammatory response. In addition primary peripheral blood mononuclear cells were assessed for cytokine and chemokine production by Bioplex and gene expression by real-time PCR.

Results: In general, titanium produced the lowest level of immune-activation as shown by the complement, NF- κ B and cytokine assays in the absence and presence of bacteria. In contrast, the polyetheretherketone samples were generally the most stimulatory of the materials; increasing complement and inflammatory cytokine activation, including NF- κ B, IL-12 and TNF- α . Interestingly oxygen plasma treatment led to increased complement activation, TNF- α and IL-12 production but decreased NF- κ B stimulation in the presence of bacteria or LPS.

Discussion/Conclusions: This *in vitro* work illustrates that there are differences in immune responses to commonly used orthopaedic materials, both in the presence and absence of additional stimulation by bacteria. Polyetheretherketone appears to be the most immune-stimulatory, especially when compared with titanium. However, to understand how these factors affect infection risk in the clinic requires an *in vivo* model due to the complexity of the immune system.

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Acknowledgments: Metal samples from Synthes, CH; PEEK samples from Invibio Biomaterial Solutions, UK.

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iMonitraf! – Implementation of Monitraf: Monitoring of road traffic related effects in the alpine space and common measures

Wagner Matthias

Institute for Regional Development and Location Management, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

Das iMONITRAF!-Projekt läuft im Rahmen des EU-Alpine Space Programmes zwischen 2009-2012. Ausgehend von der Analyse der Auswirkungen des Straßenverkehrs im alpinen Raum, speziell in den fünf am stärksten betroffenen Alpenkorridoren, wird eine gemeinsame Strategie für den transalpinen Verkehr erarbeitet und umgesetzt. Als Grundlage werden an allen Korridoren vergleichbare Indikatoren zum Monitoring erhoben. Einer dieser Indikatoren quantifiziert die Anzahl der Bewohner, die entlang der

Hauptkorridore möglicherweise kritischen Lärmemissionen aus dem transalpinen Verkehr ausgesetzt sind. Hierfür sollte eine einfache und übertragbare Methodik erarbeitet werden. Auf Basis harmonisierter Grundlagen wird versucht mit Hilfe Geografischer Informationssysteme (GIS) vergleichbare Ergebnisse zu erzielen, die betroffene Bevölkerung auf einfachem Wege und über leicht verfügbare Daten grob zu quantifizieren.

Das Institut für Regionalentwicklung und Standortmanagement der EURAC hat dafür eine Methodik entwickelt, die der Morphologie der Alpentäler ebenso wie der Lärmausbreitung Rechnung trägt. Sie wurde mit grenzüberschreitend verfügbaren homogenen Daten ohne die Verwendung von proprietären differenzierten Lärmesswerten erarbeitet. Dafür wurde die Höhenlinie 250 m über dem Verkehrsweg als beidseitige Begrenzung des betroffenen Gebietes gewählt. Diese dient der Dimensionierung des von einem Schalldruckpegel von über 60 dB(A) betroffenen Gebietes entlang der Korridore unter Berücksichtigung der Talmorphologie. Die geometrische Verschneidung der Siedlungsflächen und dem Verkehrslärm ausgesetzten Gebiet ermöglicht die Berechnung der km² pro Teilfläche innerhalb und außerhalb des betroffenen Gebietes. Anschließend wurde der prozentuale Anteil zwischen Innenfläche und Gesamtfläche je Gemeinde ermittelt. Die einzelnen Siedlungsflächen werden dann mit den Gemeinden verknüpft und daraus die Anzahl der von Lärmemissionen betroffenen Einwohnerzahl quantifiziert. Die Ausarbeitung der Methodik hat gezeigt, dass es möglich ist mit grenzüberschreitend verfügbaren homogenen Daten mittels GIS ohne die Verwendung von proprietären differenzierten Lärmesswerten vergleichbare Ergebnisse zu erzielen.

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Path analysis of factors associated with the occurrence of fractures in adults in German car collisions

Schneider Kerstin², Hainz Christian¹, Audigé Laurent², Kiss Miklos³, Nerlich Michael¹, Hanson Beate²

¹ Universitätsklinikum Regensburg, Regensburg, Germany

² AO Clinical Investigation & Documentation, Davos, Switzerland

³ Audi Accident Research Unit, Ingolstadt, Germany

Introduction: The German In Depth Accident Study (GIDAS) database includes traffic accident records related to the accident, vehicles and passengers involved. Prognostic factors for the occurrence of fractures in adult car passengers involved in a collision were explored.

Methods: Accidents from 1980 to 2010 were included. Passengers were classified by main anatomical fracture region. Prognostic variables candidates were: time of day, location of accident; car construction year, collision velocity (Delta V), car rollover, collision object, angle of impact; passenger age, gender, weight, BMI, blood alcohol level, side of impact, seatbelt used, and ejection from car. A path model of associations between factors was formulated and multi-level multivariable logistic regression was applied.

Results: The analysis included 21,721 passengers in 14,178 cars and 9,393 accidents; 1,126 passengers (5.2%) sustained at least one fracture. A significantly higher fracture risk was observed in passengers older than 60, and also in those with detectable blood alcohol levels who had a higher risk of neglecting seatbelt usage and being ejected from the car. Other risk factors included accidents outside a city (higher Delta V), car rollover, and a higher risk of passenger ejection from the car when the impact was from the side of the car and against a solid object.

Conclusions: Variable patterns most likely to cause untoward passenger injury are identifiable and may be considered in preventive programs.

Schmitt Armin O., Tagliavini Massimo
Fakultät für Wissenschaft und Technologie, Freie Universität Bozen, Bozen, Italien

Die Universität Bozen gehört mit 15 Jahren zu den jüngsten weltweit. An ihr wurde im Jahre 2007 die Fakultät für Wissenschaft und Technologie mit derzeit 27 Professoren und Forschern und 300 eingeschriebenen Studenten gegründet. Diese Fakultät zeichnet sich einerseits durch ein internationales Forschungsprofil aus, ist andererseits aber auch lokal im Alpenraum verankert. Die Fakultät sieht ihre Kernkompetenzen in den folgenden Feldern:

- Industrielles Ingenieurwesen
- Agrarwissenschaften
- Umwelt- und Forstwissenschaften
- Energie und nachhaltiges Bauen

Neben den zwei dreijährigen Bachelor-Studiengängen in Agrarwissenschaften und Agrartechnologie und in Industrie- und Maschineningenieurwesen bietet die Fakultät die beiden internationalen Master-Studiengänge in Fruit-Science, sowie ab Herbst 2012 in Energie-Ingenieurwissenschaften an. Diese englischsprachigen Programme werden in Zusammenarbeit mit den Universitäten Laibach (Ljubljana, Slowenien) und Brünn (Brno, Tschechische Republik), bzw. Trient durchgeführt. Zwei weitere post-universitäre Master-Studiengänge, Innovation Engineering und «KlimaHaus», wurden als berufsbegleitende Programme konzipiert. Auf eine berufliche Tätigkeit in der Forschung bereiten die Doktoratsprogramme «Management of Mountain Environment» sowie «Nachhaltige Energie und Technologien» vor.

Die Forschungsthemen an der Fakultät für Wissenschaft und Technologie erstrecken sich von der Verbesserung der Nahrungsmittelkette, insbesondere im alpinen Raum, über das Studium anthropogener Einflüsse auf das alpine Ökosystem bis hin zu erneuerbaren Energien und zur Optimierung von Produktionsabläufen in kleinen und mittleren Unternehmen.

Die Fakultät für Wissenschaft und Technologie der Freien Universität Bozen ist weitläufig auf lokaler, regionaler und internationaler Ebene vernetzt. Zu ihren Kooperationspartnern gehören beispielsweise die Europäische Akademie (EURAC) in Bozen, der Unternehmerverein Südtirol, die Universität für Bodenkultur (BOKU) Wien, die Technischen Universitäten Karlsruhe und München und die Chiang Mai Universität in Thailand.

Aufgrund ihrer Lage an der Schnittstelle zwischen deutschem und italienischem Sprachraum spielen neben den wissenschaftlichen Inhalten auch Sprachen eine hervorgehobene Rolle an der Universität Bozen. Lehrveranstaltungen werden im gleichen Ausmaß in den drei offiziellen Universitätsprachen deutsch, italienisch und englisch abgehalten. Obligatorisch vorhandene Grundkenntnisse in allen drei Sprachen zu Beginn des Studiums werden im weiteren Studienverlauf erweitert und mit Sprachprüfungen abgeschlossen. Ein Studienabschluss an der Universität Bozen bedeutet somit stets auch Fremdsprachenkenntnisse auf hohem Niveau.

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Sustainable use of woody biomass in South Tyrol

Boschiero Martina, Gallo Raimondo, Andreotti Carlo, Baratieri Marco, Comiti Francesco, Zerbe Stefan
Faculty of Science and Technology, Free University of Bozen-Bolzano, Bolzano, Italy

The use of biomass for bioenergy conversion has increased over the last years, due to energetic and environmental issues. However, the production and conversion of biomass and the bioenergy distribution do not necessarily imply sustainability. To assure a sustainable bioenergy chain it is necessary to i) quantify the available biomasses present in the territory, ii) plan their use in a long term vision, iii) determine the biomass energetic potential, and iv) assess environmental, economic and social impacts. In South Tyrol, a mountain province in the north-east of Italy, forest wood

plays a key role, especially for thermal energy production. However, the current forest woody biomass could not fully satisfy the demand for thermal energy, as reported in a study carried out by the Free University of Bozen-Bolzano. Other local biomass sources are needed to fill the gap. The study surveyed several woody biomass from different origins, including agriculture, riparian areas and the industrial sector. Pruning residues from orchards and vineyards could represent a suitable bioenergy source. In fact about 24,000 ha are dedicated to fruit cultivation, and the woody biomass obtainable reaches about 98,200 m³yr⁻¹. However, the harvesting and removal from the fields of the pruning residues could influence negatively both the biodiversity and the soil fertility, by modifying the ecosystem and by exporting organic matter and nutrients. Moreover, it is necessary to test if this bioenergy chain produces a significant reduction of greenhouse gases emissions respect the traditional oil-fuel chain. In a project financed by the Autonomous Province of Bozen-Bolzano, titled "Sustainable use of biomass in South Tyrol: from production to technology", the environmental impacts of this possible pruning-residues bioenergy-chain will be assessed. The results will give useful indications for a sustainable management of agricultural residues, and provide guidelines to policymakers to support a sustainable agricultural-energy-chain.

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Analysis of the fungal degradation of woodchips for heat production and the effect of different storage and pre-treatment methods

Heinek Sabrina¹, Mair Gabriel², Huber Marcel², Hofmann Angela², Monthaler Gerold³, Fuchs Hans Peter⁴, Larch Christoph⁵, Giovannini Aldo²

¹ alpS-GmbH, Innsbruck, Austria

² MCI – University of Applied Science for Environmental-, Process- and Energy Engineering, Innsbruck, Austria

³ Fernheizwerk Olang, Olang, Italy

⁴ Biomasseverband Südtirol, Toblach, Italy

⁵ Syneco GmbH, Bolzano, Italy

Objectives: Southern-Tirol shows great potential for the energy and heat production with biogenic resources. One big problem of wood combustion is the storage-related loss of biomass. Due to high water content, the growth of different fungi is enhanced, heating up the pile up to 60°C and more. Wood-destroying fungi are able to cause economical relevant losses of biomass. In addition the high temperatures can cause an auto-ignition of the woodchip pile.

On the basis of practical experiments the project tries to find the best storage and pre-treatment method for woodchips and forest residues.

Methods: The development of the temperature, water content, microbial growth, calorific value and loss of biomass of twelve different woodchip piles are monitored for one year. For achieving practical conclusions different woodchip qualities (standard-, bark-woodchips and forest residues), storage (indoor and outdoor) and pre-treatment methods (dried, fresh condition) are analyzed and evaluated.

Results: The temperature of all untreated bark and forest residue piles rose sharply during the first 5 days, peaking at 58°C. All pre-treated dry piles started declining steadily stabilizing between 10°C and 20°C. Standard woodchip piles exceeded the 30°C border marginal, holding a fewer water content. Consequently, the microbial activity is lower than that of the bark and forest residue piles.

In comparison to the moistly material, the dried biomass never reached higher temperatures than 30°C showing a low microbial activity due to the very low water content.

Conclusions: First results showed that storing fresh woodchips in a hall does not inhibit the growth of fungi and associated temperature increase. Drying the biomass leads to a marginal temperature increase inhibiting fungal growth. For further conclusions, the results of the biomass-loss analysis have to be awaited.

Carbon fluxes and allocation patterns in an apple orchard

Zanotelli Damiano¹, Montagnani Leonardo¹, Scandellari Francesca¹, Ceccon Christian¹, Melo Wellington², Cassol Paulo Cesar³, Tagliavini Massimo¹

¹ Faculty of Science and Technology, Free University of Bolzano/Bozen, Bolzano, Italy

² Embrapa Uva e Vinho, Bento Gonçalves, RS, Brazil

³ Univ. Estado Santa Catarina UDESC, Dept Solos, Lages, SC, Brazil

In the present work, an apple orchard of the Alto-Adige/Südtirol region (Italy) was investigated with the objectives to assess its carbon fluxes and allocation patterns and their relationships with the main environmental and physiological parameters. We combined three largely deployed methods, eddy covariance, soil respiration, and biometric measurements. We attributed the different components of total net primary productivity (NPP) to standing biomass increment, detritus cycle feeding, and lateral export. The net ecosystem carbon exchange (NEE), and the derived gross primary productivity (GPP), and ecosystem respiration (Reco) are reported for three complete growing seasons. The influence of environmental and physiological parameters on these three carbon fluxes was analyzed with a multiple regression model approach. We found that NEE and GPP of the apple orchard were of a magnitude comparable to those of natural forests growing in similar climate conditions, while large differences occurred in the allocation patterns and in the fate of produced biomass: the C photosynthesized was largely allocated to production of fruits: 49% of annual NPP was taken away from the ecosystem as apple production. Organic material (leaves, fine root litter, pruned wood and early fruit drop) contributing to detritus cycle was the 46% of NPP and the 5% only went to standing biomass increment. The carbon use efficiency, with an annual average of 0.68 ± 0.10 , was higher than the previously suggested values of 0.47-0.50. Low nitrogen investment in fruits, the good soil fertility level, and the optimal growth temperature (11.6°C) observed at the site are suggested as explanatory variables for the high CUE observed. Light and LAI had the strongest influence on both NEE and GPP. Yearly NEE balanced the carbon annually exported with the harvested apples allowing to support the hypothesis of a minimal net C emission to the atmosphere from the apple orchard ecosystem.

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Rationally designed aquatic receptors for on-site monitoring of endocrine disruptive compounds in waters and food processes

Heub Sarah¹, Follonier Stéphane¹, Generelli Silvia¹, Kehl Florian^{1,3}, Seneclauze Martin⁵, Aiello Vera⁴, Calzolari Luigi⁴, Colpo Pascal⁴, Ferrero Valentina⁵, Lettieri Teresa⁵, Varani Luca⁶, Haasnoot Willem⁷, Bostock John⁸, Kalaji Maher⁸, Turk Valentina⁹

¹ Centre Suisse d'Electronique et de Microtechnique, Nanomedicine, Landquart, Switzerland

² Centre Suisse d'Electronique et de Microtechnique, Microelectronics, Neuchâtel, Switzerland

³ Optics Balzers AG, Balzers, Liechtenstein

⁴ Joint Research Center, Institute for Health and Consumer Protection, Ispra, Italy

⁵ Joint Research Center, Institute for Environment and Sustainability, Ispra, Italy

⁶ Institute for Research in Biomedicine, Bellinzona, Switzerland

⁷ RIKILT Institute of Food Safety, Wageningen, The Netherlands

⁸ Elysium Projects Ltd, Bangor, United Kingdom

⁹ National Institute of Biology, Marine Biology Station, Piran, Slovenia

Endocrine disruptive compounds (EDCs) are a family of pollutants issued from the degradation of plastics, smokes and drugs. Their action on the organism is linked to feminization of aquatic species in contaminated lakes and rivers. Within the European Seventh Framework Program (FP7), the RADAR project (Rationally Designed Aquatic Receptors) aims at building an automated system for the remote monitoring of those compounds in sea and river water, and in food industrial processes. The system will include three main modules: sample preparation, optical detection, and

wireless communication. The sample preparation consists of the filtration of particles and removal of air bubbles. Then extraction, separation and pre-concentration of the target compounds are necessary steps regarding their low concentration (below ppb level) in the liquid samples. In the detection module, recombinant (estrogenic and aryl-hydrocarbon) receptors will allow a specific binding of the molecules. This binding process will be followed by two complementary methods: a waveguide grating sensor and a miniaturized surface plasmon resonance detector, which both provide high sensitive measurement and quantitative information about the presence of the pollutants in the medium. Moreover, the RADAR system will be able to communicate data and trigger alarms via a GSM module (Global System for Mobile communications). All those methods have to be completely redesigned and assembled for an on-site analysis. The following requirements have to be fulfilled: integration, automation, low power consumption, easy maintenance, low costs. The main challenge is matching various original scientific solutions to those engineering constraints.

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Advances in the SI-traceability of solar irradiance measurements

Fehlmann André¹, Winkler Rainer², Finsterle Wolfgang¹, Schmutz Werner¹, Fox Nigel², Blattner Peter³

¹ Physikalisch-Meteorologisches Observatorium Davos / World Radiation Centre, Davos, Switzerland

² National Physical Laboratory, Teddington, United Kingdom

³ Swiss Federal Office of Metrology, Bern, Switzerland

A new Cryogenic Solar Absolute Radiometer (CSAR) has been built by PMOD/WRC, NPL and METAS. We will present the component-level characterization and end-to-end calibration of the CSAR against the World Radiometric Reference (WRR) maintained by PMOD/WRC in Davos. Metrology institutes use cryogenic radiometers to define the SI radiant power scale and key comparisons between the national institutes guarantee the stability of this scale. By adapting the advantages of cryogenic radiometry for solar radiation measurements and eventually replacing the WRR by CSAR, we make the important step from a conventional standard to a directly SI traceable solar radiation reference scale.

Whilst all terrestrial Total Solar Irradiance (TSI) measurements are traceable to the WRR, some space TSI experiments are rather characterised than calibrated against a reference scale. This resulted in unexplained offsets between different instruments. The ground calibrations and on orbit measurements of our most recent space experiment – PREMOS on the French PICARD satellite – show a difference of 0.34% between the WRR and a laboratory SI irradiance scale, thus offering an explanation for the observed offsets in space. A main source for the difference is stray light which has been underestimated in the characterisation of most absolute solar radiometers. The preliminary CSAR measurements are 0.3 % lower than the WRR – confirming the PREMOS results. Thus a CSAR based reference scale would also represent the newly found absolute TSI value.

Compared to existing cryogenic radiometers the major challenges of the CSAR instrument are the determination of the integral transmittance of the entrance window, and the optical effects of the illuminated aperture. In our presentation we will focus on: 1) A short introduction to the CSAR instrument 2) The end-to-end comparison to the WRR. 3) A concept of future operation of the CSAR alongside the WRR.

Weak layer detection in simulated snow stratigraphy

Monti Fabiano, Schweizer Jürg, Fierz Charles
WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

Numerical modelling of snow cover stratigraphy with, for example, the 1D snow cover model SNOWPACK has the potential to increase the spatial and temporal resolution of snow stratigraphy information – data very much needed for avalanche forecasting. One of the key properties for interpreting snow stratigraphy in regard to stability is snow hardness. In manually observed snow profiles, differences in snow hardness between layers were found to be an indicator of instability. We improved the hardness parameterization implemented in the snow cover model SNOWPACK. Hardness is estimated from simulated snow density and grain type. Using ordinal logistic regressions we calculated for the principal grain types the threshold density for all hardness steps (on a dataset of 14'625 manually observed layers). We thus implemented snow hardness as a discrete parameter in SNOWPACK. The structural stability index (SSI), and the threshold sum approach (TSA) were then used to detect potentially weak layers. Both indices strongly depend on the hardness parameterization. Finally we compared the characteristics (grain type, grain size, hardness, depth) of the weak layers found with compression tests in 45 manual profiles with the characteristics of potential weak layers detected by SSI and TSA in the corresponding simulated profiles. The new hardness parameterization results in a better agreement between measured and simulated snow hardness. Furthermore, it does not require any further calibration and is thus more robust against future changes of the model. Simulated weak layer characteristics agreed fairly well with the observations. Nevertheless, interpreting snow instability from simulated snow stratigraphy is still more challenging than from manually observed snow profiles.

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Analysis of visitors behavior patterns based on GPS tracks from Müstair Valley, Switzerland

Dusza Przemysław Adam¹, Rupf Reto², Haller Ruedi³

¹ Faculty of Geographical and Geological Sciences, Mickiewicz University, Poznan, Poland

² Life Sciences and Facility Management, Zürcher Hochschule für Angewandte Wissenschaften, Wädenswil, Switzerland

³ Research and Geoinformation, Swiss National Park, Zernez, Switzerland

Nowadays, interactions between humans and nature are a very important subject in every visitors monitoring and management project. In recent years numerous scientific studies focused on human behavior in natural environments to create optimized methods for visitors management in ecologically sensitive areas. During the last two years project "Mafreina" located in the Val Müstair (CH) has created new methods of visitors analysis based on modern GPS devices and adapted methods of data exploration and simulation.

The study focused on visitors behavior patterns in the regional nature park with a special feature. The visitors in the Val Müstair were not obligated to stay on the designated trails. As a result the diversity of visitors behavior patterns was very high and required precise algorithms which would show where the tourists left the trails and where did they return back on them.

During the creation of algorithms various qualitative and quantitative factors had to be taken under consideration. Diverse characteristics of visitors, precision of GPS devices and means of transport were some of the main factors included in the scripts which had to narrow the examined group and create reliable results. Complexity of visitors behavior patterns required using fuzzy logic to answer the final question whether the tourists followed or stayed on the trails.

Chosen factors and methods of data analysis are the main discussion points of the study and need to be examined profoundly as they will be used to draw further conclusions for the visitor management in the regional nature park «Biosfera Val Müstair».

Cloud cover and cloud type classification using hemispherical sky cameras

Wacker Stefan¹, Gröbner Julian¹, Vuilleumier Laurent²

¹ Physikalisch-Meteorologisches Observatorium Davos / World Radiation Center, Davos Dorf, Switzerland

² Federal Office of Meteorology and Climatology, MeteoSwiss, Switzerland

Clouds are a key parameter in the climate system and remain the largest uncertainty in terms of climate change mainly due to numerous deficiencies in observing clouds from ground and space. The longest record of cloudiness comes from human observers. These observations include fractional cloud cover and cloud types at low, mid, and high levels. However, human eye observations are to some extent subjective and less frequently performed. Thus, they are often replaced by automatic devices or even totally cancelled, also due to the high costs associated with human observers.

We present a method to calculate fractional cloud cover and to classify clouds with high temporal resolution using hemispherical sky cameras. The system consists of a commercial digital camera and a 180° field of view optic (fish eye) protected by a glass dome. The cloud cover can be calculated by comparing the values of the blue, red and green channels to a threshold which allows discriminating between cloudy and cloud-free pixels. For the cloud type classification the k-nearest-neighbor (kNN) method is used which is a statistical and supervised classifier. „Supervised“ implies that a training set is visually created containing images of all different cloud classes in order to train the classifier. The algorithm itself is based on various spectral and textural features of an image. These features are characteristic for a specific cloud type and are calculated for each image of the training set. A new image is then classified by comparing its features with those from the training set. The assignment to a specific cloud class is performed by majority vote; i.e. the class associated with the majority of the k-closest matches of the feature space of the training set compared to the feature space of the test image determines the class of the image.

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Monitoring temporal changes within the snowpack utilizing upward-looking radar systems

Schmid Lino¹, Mitterer Christoph¹, Schweizer Jürg¹, Heilig Achim^{2,3,4}, Eisen Olaf^{3,4}, Okorn Robert⁵

¹ WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

² Department of Geosciences CGISS, Boise State University, Boise (ID), USA

³ Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany

⁴ Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany

⁵ Electronic & Technology Management (ETM), FH JOANNEUM, Kapfenberg, Austria

As the seasonal snow cover exists close to its melting point, the snow structure is constantly changing. Furthermore, the snowpack is spatially variable. Therefore, the evolution of snow stratigraphy can only be followed if using a non-destructive, continuously operating sensor system. Such systems should provide information on snow layering, snow settling, i.e. strain rates for specific layers after recent loading by precipitation, or the propagation of a wetting front.

For this study, two different upward-looking radar systems buried in the ground recorded continuous data of snow stratigraphy during the winter seasons 2010/2011 and 2011/2012. Under dry-snow conditions every three hours a measurement was performed; as soon as parts of the snowpack were wet, the sampling rate was changed to two measurements per hour. In addition to a previously installed and tested upward-looking impulse radar system (upGPR) a low-cost self-assembled frequency modulated continuous wave system (upFMCW) in a similar frequency range was buried in the ground. We compare the radar signals gathered

with two different frequencies (600, 1600 MHz) with the upGPR to the signals recorded with the upFCW in the frequency range of 1-2 GHz. Under dry-snow conditions, the radar offers the unique possibility to follow the evolution of internal snow layers, in particular to monitor settling rates of single layers. Under wet-snow conditions, the occurrence of strong multiple reflections as well as the daily increase in two-way travel time of reflection horizons allow one to determine the absolute amount of liquid water, the depth of a wetting front, the timing of the daily peak in volumetric liquid water content and its decreasing due to refreezing during the night.

36 Variability of the solar irradiance: A quest for understanding

Shapiro Alexander¹, Schmutz Werner¹, Cessateur Gael¹, Rozanov Eugene^{1,2}

¹ Physikalisch-Meteorologisches Observatorium Davos / World Radiation Centre, Davos Dorf, Switzerland

² ETHZ, Zurich, Switzerland

Solar radiation is the main source of energy to the terrestrial atmosphere. At the same time the Sun is a variable star whose activity changes over time-scales ranging from minutes to millennia. Assessing the contribution of solar activity to natural climate change is a topic of current importance. For example, it allows one to estimate the consequences of a potential strong decrease of the solar activity, which is predicted in the middle of 21st century.

However, this topic remains controversial as, although the variability of the solar irradiance was suspected as early as in the mid-nineteenth century, its complete picture is still missing. We present the theoretical model of the solar variability, recently developed at PMOD/WRC. The model is based on a state-of-the-art solar radiation code and allows us to reconstruct the solar spectral irradiance back to 7000 BC. Our reconstruction was successfully used for simulating past and future climate by numerous international groups. We discuss their main results and outline observational programs which can help to constrain the estimations of the solar long-term variability.

We compare the Sun with Sun-like stars and address the question of whether the Sun is a typical star or an outlier among its stellar cohort.

37 Satellite data and ground measurements for assessing solar radiation in the alpine region

Castelli Mariapina^{1,2}, Petitta Marcello¹, Tetzlaff Anke¹, Stoeckli Reto³, Zebisch Marc¹

¹ Institute for Applied Remote Sensing, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy;

² DICA, University of Trento, Italy

³ Federal Office of Meteorology and Climatology, MeteoSwiss, Switzerland

The assessment of solar energy in the Alpine region for supporting photovoltaic (PV) applications requires the thorough consideration of three contributors: topography, the atmosphere and clouds.

Topography causes high spatial gradients in surface radiation. Furthermore nearby objects produce shadowing which can be found by Geographic Information Systems (GIS) by calculating the local horizon angle from a Digital Elevation Model (DEM) of the area of interest. We analyzed these effects for the Alpine town Bressanone, in South Tyrol: we computed clear sky irradiance, and corrected it with the 30 year time series of irradiance measured by the closest meteorological station. Results were published on the web page www.cittasolare.it.

The atmosphere influences the earth's energy budget through absorption and scattering. We consider the impact of column amount of water vapor and ozone, and aerosol optical thickness and single scattering albedo. According to our calculations for Bolzano, performed by the Radiative Transfer Model (RTM) libRadtran with inputs from MODIS and AERONET, aerosols can generate a variation of diffuse irradiance between 20 and 130 W/m².

Clouds absorb IR radiation, produce surface shadowing, and scatter solar radiation. We exploit geostationary satellites to examine these effects, and use the method developed by MeteoSwiss for the Alps, which is a revision of the HELIOSAT algorithm. We validated this model in Bolzano against ground data. The validation of the monthly averages shows a good agreement between satellites and ground measurements of global irradiance (R² = 0.976, Mean Absolute Bias (MAB) = 9.622%). In contrast a strong discrepancy is observed for diffuse (MAB = 22.726%) and direct normal irradiance (MAB = 23.256%). The validation of the daily averages confirms the difficulties of satellites in estimating diffuse irradiance (MAB = 32.367%). According to these results, an adjustment of the algorithm of MeteoSwiss is necessary for better estimating diffuse irradiance.

38 Forschungsförderung in Graubünden

Jäger Martin

Regierungsrat, Vorsteher Erziehungs-, Kultur- und Umweltschutzdepartement des Kantons Graubünden, Chur, Schweiz

Der Kanton Graubünden ist nicht nur für seine attraktive Landschaft und reichhaltige Kultur bekannt, er ist auch Standort von renommierten Forschungs- und Bildungsinstitutionen, die zum Teil vor mehr als 100 Jahren gegründet wurden. Das Interesse an Lage, Klima und Kultur Graubündens, aber auch modernste Forschungseinrichtungen der «Lebenswissenschaften» sind Magnete für Wissenschaftler. Der Kanton gehört nicht zu den 8 Schweizer Universitätskantonen, aber er stärkt den universitären Bereich im Bewusstsein, dass die Forschung zukunftsorientierte wissenschaftliche und wirtschaftliche Auswirkungen hat.

Die Forschung in Graubünden wird durch internationale, nationale und kantonale Mittel gefördert. Die internationalen Mittel werden von der Schweizerischen Eidgenossenschaft für internationale Zusammenarbeit oder von ausländischen Institutionen (z.B. National Institutes of Health, Bethesda, USA) für internationale Netzwerkprojekte zur Verfügung gestellt. Dazu gehören auch die Rahmenprogramme für Forschung und technologische Entwicklung der Europäischen Union. Die Schweiz ist dort seit 2004 ein assoziiertes Mitglied, weshalb ihre Institutionen sich mit allen Rechten und Pflichten um diese Mittel bewerben können.

Die nationalen Fördermittel werden über den Schweizerischen Nationalfonds (SNF) oder die Kommission für Technologie und Innovation (KTI) verliehen. Der SNF ist vorwiegend für die Grundlagenforschung, die KTI für die angewandte Forschung zuständig. Der Bund hat zusätzlich die Möglichkeit, Institutionen von nationaler Bedeutung durch einen direkten Beitrag zu unterstützen, wobei das Interesse des Standortkantons durch eine ebenbürtige Unterstützung dokumentiert sein muss. In Graubünden sind dies das Institut für Kulturforschung Graubünden in Chur und das Schweizerische Institut für Allergie- und Asthmaforschung in Davos. National sind auch die Fördermittel im Rahmen der Neuen Regionalpolitik, die auf einer Mit-Förderung durch den Kanton beruhen.

Die kantonale Förderung wird zurzeit in Graubünden auf eine neue gesetzliche Basis gestellt. Die Verabschiedung dieses Gesetzes wird es ermöglichen, Forschungsinstitutionen durch entsprechende Leistungsverträge zu fördern, an ihre Grundfinanzierung beizutragen und somit im Rahmen des neuen FIG die Gewährung von Bundesbeiträgen zu ermöglichen.

39 Forschungsförderung in Südtirol und Italien

Andergassen Günther

Abteilung Bildungsförderung, Universität und Forschung, Autonome Provinz Bozen – Südtirol, Bozen

Die Förderung der Grundlagenforschung und der angewandten Forschung in Südtirol ist noch relativ jung. Über das Land- und Forstwirtschaftliche Versuchszentrum Laimburg (seit 1975), die Europäische Akademie Bozen (seit 1992) und die Freie Universität Bozen (seit 1997) konnten erste Ansätze eines Forschungssystems herausgebildet werden.

Die entscheidende Grundlage für die Forschungsförderung wurde mit dem Landesgesetz Nr. 14 vom 13. Dezember 2006 geschaffen, welches die Errichtung eines Landesinnovations- und Forschungssystems vorsieht. Im Vordergrund der Bemühungen des Landes steht seither die Förderung und Ausbildung durch Forschung und die Förderung einer Wissenskultur – einer Forschungskultur mit entsprechendem Wissenstransfer und dem Aufbau von Netzwerken.

2008 wurde die „Durchführungsverordnung zur Förderung der Forschung“ genehmigt, welche eine breite Palette an Maßnahmen zur Forschungsförderung vorsieht, die in den nächsten Jahren schrittweise umgesetzt werden sollen.

Um eine Richtung vorzugeben, in die sich die Forschung in den nächsten Jahren entwickeln soll, wurde 2008 in Zusammenarbeit mit den lokalen Forschungsakteuren ein mehrjähriger Landesplan für Forschung und Innovation in Südtirol erarbeitet. Der Plan entwickelt Strategien, die über einen Zeithorizont von 5-10 Jahren das Ziel verfolgen, leistungsfähige Institutionen herauszubilden und diese durch die Bereitstellung von notwendigen Ressourcen zu stärken. Andererseits soll ihnen ausreichend Autonomie gewährt werden, die es ermöglicht, die Geldmittel möglichst effizient einzusetzen und einen vitalen Beitrag zur Entwicklung von Humanressourcen zu leisten. Im Sinne des Mehrjahresplanes wurden mit der Freien Universität Bozen und der Europäischen Akademie Bozen mehrjährige Leistungsvereinbarungen abgeschlossen, die diesen Einrichtungen mittelfristige Planungssicherheit gewährleisten sollen.

In den Jahren 2009–2012 wurden erste Prioritäten in der Förderung von Forschungsprojekten und der Mobilität von ForscherInnen gesetzt. Im Jahr 2012 sollen erstmals ein Schwerpunktvorhaben gefördert und zwei Wissenschaftspreise eingeführt werden. Ein prioritäres Ziel ist es, die Bevölkerung durch verschiedene Initiativen für die Bedeutung wissenschaftlicher Forschung zu sensibilisieren.

Über die Forschungsförderung durch das Land Südtirol hinaus besteht für die Forschungseinrichtungen die Möglichkeit, von Seiten der Europäischen Union und des Italienischen Ministeriums für Unterricht, Universität und Forschung Mittel für Forschungsprojekte zu akquirieren. Letzteres sieht insbesondere Förderungen für Projekte von nationalem Interesse (Progetti di ricerca di interesse nazionale) und einen Fonds für Investitionen in Grundlagenforschung (Fondo per gli investimenti della ricerca di base) vor.

40 Forschungsförderung im Tirol

Gohm Harald

Standortagentur Tirol, Innsbruck, Österreich

Die Standortagentur Tirol ist von der Tiroler Landesregierung per Gesetz dazu beauftragt, den Wirtschafts- und Wissenschaftsstandort Tirol nachhaltig zu stärken, um damit bestehende Arbeitsplätze zu sichern und neue zu schaffen. Sie unterstützt heimische Unternehmen, Forschungseinrichtungen, Regionen und Gemeinden mit umfassenden Beratungs- und Serviceleistungen. Diesen Zielgruppen gelingt es dadurch zukunftsfähige Projekte erfolgreich zu initiieren und umzusetzen.

Eine wichtige Basis hierfür sind monetäre Förderungen, welche eine gewisse Abfederung des Risikos von Innovationsprojekten für die Unternehmen darstellen. Die Republik Österreich sowie das Land Tirol bieten hierfür eine sehr breite Palette an Förderungsprogrammen an, welche in allen Phasen eines Innovationsvorhabens zum Tragen kommen können.

Es gibt Förderungen für erste Schritte in einem Entwicklungsprojekt (bspw. das Initiativprogramm des Landes Tirol oder den Innovationsscheck der Bundes-Forschungsförderungsgesellschaft FFG) und Unterstützungen für kleinere oder größere Einzel-Forschungsprojekte. Zudem gibt es – meist höher dotierte – finanzielle Förderungen von mehrjährigen Forschungsk Kooperationen (z.B. K-Regio Programm des Landes Tirol oder COMET-Programm der FFG).

Die Förderungen werden entweder als nicht rückzahlbare Zuschüsse oder als zinsgünstige Darlehen vergeben. In manchen Programmen (unter anderem Basisprogramm der FFG) gibt es einen Mix von Zuschuss und Darlehen. Die Größenordnungen liegen

bei den Landesprogrammen zwischen EUR 5.000 (Initiativprogramm) und EUR 900.000 (K-Regio). Bei den FFG-Programmen können die Förderungsbeiträge auch über der Millionengrenze liegen.

Die Tiroler Unternehmen und Forschungseinrichtungen sind durchaus sehr erfolgreich, was die Beantragung von Forschungsförderungen betrifft. Beispielsweise beim 7. Forschungsrahmenprogramm der EU wurden über 160 Anträge mit Tiroler Beteiligung genehmigt. Damit liegt Tirol innerhalb Österreichs in Relation zur Einwohnerzahl sehr weit vorne.

Gerade die EU-Programme sind ein gutes Beispiel für grenzüberschreitende Zusammenarbeit, insbesondere auch der Regionen im Alpenraum. Ebenso könnte auch bei anderen Programmebenen (bspw. Bundes-, Landes- bzw. Kantonalprogramme) eine Kooperation forciert werden, indem koordinierte Ausschreibungen in den einzelnen Ländern erfolgen. Dadurch könnte der grenzüberschreitende Wissenstransfer forciert werden und eine gegenseitige Befruchtung zum Wohle aller erfolgen.

POSTER PRESENTATIONS

P1

Sportliche Aktivität nach intraartikulärer Tibiakopffraktur bei Skifahrern

Bäumlein Martin¹, Massen Felix¹, Georgiev Boyko², Glaab Richard¹, Perrer Thomas¹, Rillmann Paavo¹, Ryf Christian¹, Friedl Gerald¹, Loibl Markus^{1,3}

¹ Spital Davos, Chirurgie-Orthopädie, Davos, Schweiz

² AO Research Institute, Biomedical Services, Davos, Schweiz

³ Klinikum der Universität Regensburg, Abteilung für Unfallchirurgie, Regensburg, Deutschland

Fragestellung: Verletzungen im Bereich des Kniegelenkes repräsentieren 20–25% aller Verletzungen beim Skifahren. Neben ligamentären Schäden stellen Frakturen der proximalen Tibia eine der schwerwiegendsten Verletzungen dar. Ziel dieser Studie war es, den Langzeitverlauf mit Auswirkungen auf die sportlichen Aktivitäten nach intraartikulärer Tibiakopffraktur zu erheben.

Methodik: Zwischen 01/2000 und 12/2006 wurden 172 Skifahrer mit intraartikulärer Fraktur der proximalen Tibia im Spital Davos operativ behandelt. Alle deutschsprachigen Patienten (108/172) wurden telefonisch und postalisch kontaktiert. Mittels validierter Fragebögen wurden Outcome, die sportliche Aktivität und die Zufriedenheit erhoben.

Ergebnisse: Insgesamt standen 92 Fragebögen zur Auswertung zur Verfügung (89,3%). Bei einem durchschnittlichen Alter von 52,2 Jahren (Spannweite 21–76) und einem BMI (Body Mass Index) von 24,3 kg/m² (Spannweite 17–30) mussten bei 42 Männern und 50 Frauen neben Typ B3 (36%), B2 (22%) auch Typ C3 Frakturen (19%) am häufigsten versorgt werden. Beim Nachuntersuchungszeitraum von durchschnittlich 7,8 Jahren (Spannweite 5–10) blieben 88% der Patienten weiterhin sportlich aktiv, wobei nur einer von insgesamt acht Patienten wieder in den Leistungssport zurückkehren konnte. Während 62% ihr Aktivitätsniveau aufrechterhalten konnten, kam es bei 38% zu einer Verschlechterung. Die Anzahl aktiv ausgeübter Sportarten reduzierte sich (5,5 vs. 4,3; p<0,001) bei gleich bleibender Intensität. Es zeigte sich ein signifikanter Abfall des Tegner Aktivitätsscores (4,6 vs. 3,9; p<0,001), des Lysholm Scores (99,5 vs. 89,1; p<0,001) und des Oxford Knee Scores (47,7 vs. 44,5; p<0,001). Bei separater Analyse der Frakturtypen war der Abfall jedoch ausschließlich bei Typ B3 und Typ C3 Frakturen signifikant.

Schlussfolgerung: Adäquat operativ versorgte intraartikuläre Tibiakopffrakturen haben insgesamt eine gute Prognose hinsichtlich Wiederherstellung der Gelenkfunktion und Patientenzufriedenheit. Die meisten Patienten können einen sportlich aktiven Lebensstil beibehalten, wobei das Ausmaß der Gelenkflächenzerstörung einen entscheidenden Einfluss auf die langfristige Belastungsfähigkeit hat. Insbesondere Leistungssportler müssen mit erheblichen Einschränkungen rechnen, die möglicherweise spezielle postoperative Rehabilitationsprogramme erfordern.

P2

The passage of a hemodialysis filter affects hemorheology, red cell shape, and platelet aggregation

Cagienard Flavio¹, Schultzi Thomas², Furlong Pamela I.³, Venzin Reto M.¹, Reinhart Walter H.¹

¹ Department of Internal Medicine, Kantonsspital Graubünden, Chur, Switzerland

² Department of Internal Medicine, Division of Transfusion Medicine, Kantonsspital Graubünden, Chur, Switzerland

³ AO Research Institute, Davos, Switzerland

Background: Hemodialysis may be accompanied by complications such as hypotension, cramps, chest pain, et cetera. We have investigated the influence of the passage of a hemodialysis filter on red blood cells (RBCs) and platelets.

Methods: After one hour of hemodialysis blood was drawn immediately ahead and behind the dialysis filter. RBCs were fixed in 1% glutaraldehyde for morphological analysis. Blood viscosity was measured with a Couette viscometer (LS-30, Contraves); RBC aggregation with a Myrenne aggregometer. Platelet aggregation was measured in flowing whole blood (PFA-100) and in platelet

rich plasma (Chrono-log 700).

Results: Fifteen patients were studied. The passage of blood through the hemodialysis filter had marked effects: The hematocrit increased from 34±3.8 to 44.6±8.7% (p<0.01). Normally shaped RBCs (discocytes) decreased from 73±9 to 60±15%, while echinocytes and knizocytes (triconcave instead of biconcave RBCs) were more abundant (both together: 24±9 and 38±15% ahead and behind the filter, respectively, p<0.01). Blood viscosity increased from 3.77±0.52 to 6.75±2.21 mPa.s (p<0.01); with the hematocrit adjusted to that ahead of the filter 5.03±1.63 mPa.s (p<0.01). Plasma viscosity increased from 1.28±0.09 to 1.8±0.34 mPa.s (p<0.01). The RBC aggregation index (M1) was decreased after the filter passage: 25.8±5.0 and 20.9±5.6 (p<0.05). These changes were less pronounced when the flow rate was reduced from 350 to 100 ml/min. Platelet aggregation in flowing blood (PFA-100) was increased after the filter (Closure time 180±57 and 158±51 s, respectively, p<0.05), probably due to the increased hematocrit. On the contrary, platelet aggregation in platelet rich plasma was decreased from 65.4±8.5 to 37.2±11.3% (p<0.05).

Conclusion: The passage of a hemodialysis filter induced RBC shape changes (knizocytes and echinocytes), increased the hematocrit and blood viscosity; and decreased RBC aggregation. Platelet aggregation was increased in flowing whole blood, but decreased in plasma. These changes may have a clinical impact.

P3

Sind virtuelle Hausbesuche durch Bezugspersonen von älteren Menschen eine praktikable, verlässliche und valide Alternative zu Wohnraumabklärungen vor Ort durch ErgotherapeutInnen?

Daniel Heike^{1,4}, Oesch Peter^{2,4}, Stuck Andreas³, Born Stephan³, Bachmann Stefan^{2,3,4}

¹ Therapieabteilung, Ergotherapie, Kliniken Valens, Rehabilitationszentrum Valens, Valens, Schweiz

² Forschungsabteilung, Kliniken Valens, Rehabilitationszentrum Valens, Valens, Schweiz

³ Inselspital Bern, Geriatrie Universität Bern, Bern, Schweiz

⁴ Klinik für Rheumatologie und internistische Rehabilitation, Kliniken Valens, Rehabilitationszentrum Valens, Valens, Schweiz

Hintergrund: 30–60% der Stürze älterer Menschen sind durch Umweltfaktoren im Wohnbereich bedingt. Ergotherapeutische Wohnraumabklärungen können sturzrelevante Umweltfaktoren identifizieren, sind jedoch kostenaufwändig. Als Alternative zur Wohnraumabklärung wurde ein virtueller Hausbesuch entwickelt, bei dem Bezugspersonen mit Hilfe eines Regiebuches eine Fotodokumentation des Wohnraumes durchführen.

Fragestellungen: Es sollte untersucht werden, ob virtuelle Hausbesuche bei über 65-jährigen Patienten zu denselben Resultaten in Bezug auf die Ermittlung von Umweltfaktoren führen und ob diese kostengünstiger sind als Wohnraumabklärungen vor Ort. Auch die Akzeptanz des virtuellen Hausbesuchs durch die ihn durchführenden Bezugspersonen und die auswertenden ErgotherapeutInnen sollte ermittelt werden.

Methode: Zum Vergleich des virtuellen Hausbesuchs mit der Wohnraumabklärung vor Ort wurde eine Querschnittsuntersuchung durchgeführt. Die Praktikabilität wurde durch Gegenüberstellung des finanziellen Aufwands, die Akzeptanz mittels Fragebögen untersucht. Zur Bestimmung der Reliabilität wurden Intraclass-Korrelationskoeffizienten und Cohens-Kappa-Koeffizienten berechnet, die Validität wurde durch Berechnung von Sensitivität und Spezifität bestimmt.

Ergebnisse: Es wurde der Wohnraum von 20 PatientInnen untersucht. Der Kostenaufwand war beim virtuellen Hausbesuch um 53% geringer als bei Wohnraumabklärungen. Die Befragung der Bezugspersonen und der ErgotherapeutInnen ergab eine gute bis sehr gute Akzeptanz des virtuellen Hausbesuchs. Die Reliabilität erwies sich als überwiegend gut bis sehr gut. Mit einer Gesamtsensitivität von 78.9% und einer Gesamtspezifität von 84.9% war auch die Validität des virtuellen Hausbesuchs hoch. Eine ungenügende Reliabilität und Validität zeigte der virtuelle Hausbesuch bei der Beurteilung von rutschigen Boden- und Treppenbelägen und von Platzverhältnissen.

Schlussfolgerungen: Der virtuelle Hausbesuch stellt eine kostengünstige, von Bezugspersonen und ErgotherapeutInnen akzeptierte und weitestgehend verlässliche und valide Alternative zu

Wohnraumabklärungen vor Ort bei älteren Menschen dar. Er hat gute Fähigkeiten zur Erkennung von Gefahrenquellen und Barrieren im Wohnraum. Zur Erhöhung der Reliabilität und Validität sollten ErgotherapeutInnen zusätzliche Informationen bei den PatientInnen und/oder deren Bezugspersonen einholen.

P4 **Press-fit biphasic scaffolds in an osteochondral defect model in rabbits**

Dresing Iska, Zeiter Stephan, Auer Jörg, Alini Mauro, Eglin David
AO Research Institute, Davos, Switzerland

Introduction: Treatment of articular cartilage lesions is limited due to the fact, that there is only little self-healing capacity. Although there are a variety of treatments, there is no optimal method to repair the defect tissue. A promising treatment option is tissue engineering, a method to create new tissue using scaffolds and biologics. Although scaffold stability within the injured site and a good interaction with the surrounding tissue is requested, a scaffold should avoid bone ingrowth in the cartilage part.

Aim: It was first hypothesized, that an elastomeric scaffold press-fitted in an osteochondral defect will stay in place without the need of fixation, e.g. suturing. Then, it was proposed that a scaffold composed of two parts optimized respectively for bone ingrowth and cartilage tissue engineering, with a micro-porous separating membrane would limit the bone ingrowth to the scaffold bony region and allow the application of biological therapies in the cartilage region. Therefore, we studied the functional integration and stabilization of elastomeric biphasic scaffolds implanted in an osteochondral defect in rabbits.

Material and methods: Three millimetre diameter elastomeric polyester-urethane scaffolds with/without a micro-porous membrane between the osseous and cartilage parts were prepared and sterilized. Eighteen rabbits were used and split into three groups (empty defect, scaffold with membrane, and scaffold without membrane). An osteochondral defect (2,7 mm diameter x 4 mm depth) was created in the central area of the medial trochlear ridge. The defects were left empty or a scaffold press-fitted into the defect. After twelve weeks the rabbits were euthanized and the samples were histologically analyzed.

Results: Press-fitted elastomeric scaffolds remained in the osteochondral defect after twelve weeks implantation without the need of fixation. Histological analysis should confirm the influence of the scaffolds composition and structure.

P5 **Long term tissue reaction induced by ChronOS™ inject bone cement use in distal radius fracture voids**

Duda Sven H.^{1,2}, Sprecher Christoph M.¹, Arora Rohit², Lutz Martin², Sitte Ingrid², Blauth Michael², Milz Stefan^{1,3}

¹ AO Research Institute, AO Foundation, Davos, Switzerland.

² Department of Surgery and Sports Medicine, Medical University Innsbruck, Innsbruck, Austria

³ Department of Anatomy, Ludwig-Maximilians University, Munich, Germany

Biodegradable calcium phosphate cements such as ChronOS™ Inject are frequently used in human patients but long term data regarding resorption characteristics in cancellous metaphyseal bone are lacking.

Six human patients (age range 62–81 years) with a dorsally displaced distal radius fracture were operated with volar locking plate systems and additionally treated with ChronOS™ Inject application into the remaining cancellous bone defect. During implant removal (implantation time 6–15 months, average time in situ 11 months) a 2 mm diameter biopsy was collected from the previous defect area that was filled with bone cement. In all samples the area of bone, osteoid and remaining tissue were determined and the occurrence of cement particles, bone marrow fibrosis and signs of inflammation were recorded.

Apparently living bone tissue, osteoid formation, mast cell occurrence and marrow fibrosis were detected in most samples. Different and most cases small amounts of granular material identified

as remnant of the bone cement were detected in all specimens. Agglomerations of granular material were frequently surrounded by bone tissue and islets of newly formed osteoid in direct contact with the remaining cement also occurred. Bone density (i.e. area of bone per region of interest) ranged between 6.9 and 36.2% and osteoid density between 0.5 and 7.8%. Bone osteoid ratio was higher in patients who did not receive osteoporosis medication and lower in patients who received it (range 6.0–32.1). The present study shows that small amounts of ChronOS™ Inject are present in human cancellous bone 15 months after implantation into a cancellous distal radius defect. During bone tissue remodelling ChronOS™ Inject is integrated into the newly formed trabecular meshwork.

P6 **The influence of bone cement stiffness modifications on implant anchorage in osteoporotic bone**

Eberli Ursula^{1,2}, Fliri Ladina¹, Gueorguiev Boyko¹, Lorenzetti Silvio²

¹ AO Research Institute, Davos, Switzerland

² ETH Zurich, Institute for Biomechanics, Zurich, Switzerland

Polymethylmethacrylate (PMMA)-based bone cements showed promising results in biomechanical studies of augmented implants. Most of the PMMA-usage associated risks can be reduced by minimising the amount of bone cement. Appropriate bone cement localisation around implants is one way to achieve a minimisation. Having bone cement with more ideal mechanical properties (stiffness) for osteoporotic bone might be another way, based on the assumption that less stiff bone cement leads to smoother load distributions at the bone-cement interface due to an increased contact area as a result of its increased deformation. Initiating with an abstract, experimental approach to the point of a clinically relevant model, this study aims at investigating the effect of reduced bone cement stiffness on actual peak stresses in osteoporotic bone. A generalised model of a bone-(cement)-implant interface was tested mechanically and analysed with finite element (FE) methods. Besides mechanical cyclic loading of a clinically relevant case simulated in surrogate foam, static loading of a cadaveric femoral head instrumented with an augmented proximal femoral nail antirotation (PFNA) blade was performed mechanically and analysed with the FE method. Stiffness adapted bone cements were used in these models. Compared to commercially available bone cement, the use of stiffness adapted bone cement lead to significantly inferior results in the mechanical tests. FE analysis revealed only slightly lower values in maximal Von Mises stresses in bone tissue when simulating stiffness adapted bone cement. It is assumed that the main benefit of using bone cement is the achievement of an increased load bearing area between bone and implant and an increased volume of trabecular structures that are loaded coincidentally with each other. Stiffness reduction of already commercially available PMMA-based bone cements seems not to lead to an improvement of the load distribution at the bone-cement interface and hence, does not reduce peak stresses.

P7 **International Alpine Trauma Registry: An integration of expertise in medicine and information technology**

Frasnelli Andreas¹, Rilk Christopher², Strapazzon Giacomo², Onomoni Annalisa³, Mair Peter⁴, Brugger Hermann²

¹ Swiss Air Rescue (REGA), Zürich, Switzerland

² Institute of Mountain Emergency Medicine, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

³ Information and Communication Technologies, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

⁴ Department of Anaesthesiology and Critical Care Medicine, Innsbruck Medical University, Innsbruck, Austria

Providing medical care to seriously traumatized patients in alpine environments or in remote areas poses a unique challenge due to extreme environmental conditions, demanding terrain, and long rescue and transport times. The primary aim of the International Alpine Trauma Registry research project is to create a unique

global database to enable an international comparison between different strategies applied during the rescue of traumatized patients. The data collection involves a multi-centre collaboration between emergency medicine departments, intensive care and reanimation units, and emergency services. The original partnership was founded between five hospitals in South Tyrol, the Emergency Service 118/115 of the Autonomous Province of Bolzano, the archives of the National Corpus of the Mountain Emergency Medical Services, the Innsbruck Medical University Hospital and the air rescue services in North Tyrol. In the future other hospitals in different countries in Europe and North America will be included as partners, and the collaboration with the regional hospital in Chur and the Swiss Air Rescue service is planned for 2013.

The study aims at enhancing the medical knowledge in the field of prehospital emergency care of traumatized patients. The results are expected to lead to important insights and progress in this healthcare sector.

P8

Immune response of human leukocytes to the xenogenic molecule Neu5Gc

Frei Remo^{1,2}, Ferstl Ruth¹, Konieczna Patrycja¹, Ziegler Mario¹, Loeliger Susanne^{2,3}, Roduit Caroline^{2,3}, Akdis Cezmi A.¹, O'Mahony Liam¹, Lauener Roger P.^{2,4}

¹ Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland

² Christine Kühne-Center for Allergy Research and Education, Davos, Switzerland

³ University of Zurich, Children's Hospital, Zurich, Switzerland

⁴ Hochgebirgsklinik Davos-Wolfgang, Davos, Switzerland

Background: The farm environment has been shown to influence the risk for development of atopic disease. As suggested by the hygiene hypothesis, microbes or microbial compounds are thought to be influential environmental factors. However, the farm environment confers additional exposure to non-microbial mammalian-derived molecules that might influence immunoregulation. One such molecule is the sialic acid N-glycolylneuraminic acid (Neu5Gc), which is not present on human cells but is present on other mammalian cells.

Aim: To investigate the immunoregulatory influence of Neu5Gc on human leukocytes.

Methods: PBMCs, monocyte-derived dendritic cells (MDDCs), T and B cells were isolated from healthy donors by MACS sorting and stimulated with Neu5Gc for different time points and at different doses. Cellular phenotypes, cytokine release, and gene expression were quantified by flow cytometry, Bioplex and qPCR respectively.

Results: Stimulation of PBMCs with Neu5Gc enhanced polarization of all T helper cell phenotypes (TH1, TH2, TH17 and TREG). Neu5Gc-stimulated MDDCs secreted inflammatory cytokines, such as TNF-alpha and IFN-gamma, while also increasing expression of the regulatory molecules IDO, RALDH2, SOCS-3, and IL-10. Finally, B cells secreted IL-10 after stimulation with Neu5Gc and B cell-T cell co-cultures, in the presence of Neu5Gc, reduced the percentage of Gata-3 positive TH2 cells. Conclusion: Xenogenic molecules of mammalian origin are immunostimulatory and may play a role in the protective influence of the farm environment on atopic disease.

P9

Dendritic cells targeting and improved cell penetration in allergen-specific immunotherapy

Garbani Mattia, Rhyner Claudio, Cramer Reto
Swiss Institute for Allergy and Asthma Research (SIAF), Molecular Allergology, University of Zurich, Davos, Switzerland
mattia.garbani@siaf.uzh.ch

Today's therapies for allergic diseases aim to induce a switch towards a T_H1/T_{reg} dominated immune response by challenging the patient with increasing doses of allergen. This approach has two major disadvantages: the duration of the treatment and the anaphylactic side-effects.

The Modular Antigen Translocation (MAT) Vaccine consist of a cell penetration peptide linked to a part of invariant-Chain (Li). In the cell Li targets the immunogenic protein directly to MHC-II, therefore ⁱ less antigen is needed and ⁱⁱⁱ less injections are necessary. MAT vaccines are potentially internalized in every cell and do not specifically target antigen presenting cells. Moreover they show the undesired feature of migrating to the nucleus. The aim of the project is to create a new generation of vaccines where the TAT peptide is substituted or supplemented by newly discovered peptides, lacking nuclear localization sequence or able to specifically target dendritic cells.

By confocal microscopy and flow cytometry it was shown that, when added exogenously and fused to a protein of interest, CPP512 triggers the internalization of the construct into HeLa cells without driving it towards the nucleus. Additionally, using Green Fluorescent Protein fusions, we were able to confirm the specific targeting of the DC-specific peptide pep3. Pep3 constructs were specifically binding to DCs, but not to other investigated cell types like CaCo-2 and THP1.

In the next stage the efficacy of the modified versions of the MAT vaccine will be tested in vivo in mouse models of allergy.

P10

Challenges in 3D computer modeling of the jaws

George Joseph, Erdöhelyi Balazs, Kamer Lukas
Human Morphological Services/Preclinical Services, AO Research Institute, Davos, Switzerland

Three-dimensional (3D) computerized medical imaging is a rapidly developing field in research & development and in clinical applications. For dental applications and for craniomaxillofacial surgery there is a need to have highly accurate computer models of the jaws for diagnostic procedures, for treatment planning as well as for treatment tracking available. Computed Tomography (CT) or Cone Beam Computed Tomography (CBCT) is usually acquired to get 3D information about the bony structures. However the teeth cannot be properly visualized because of lack of sufficient image resolution, difficulties in segmentation and separation of upper from the lower teeth, interaction with metallic dental restorations that create streak artifacts, and errors accumulated while processing the data. To get an accurate computer model of the jaws CT or CBCT might be merged to 3D laser scanning of the dental occlusion. Still a proper workflow needs to be defined, especially with regard to accurately align the two different imaging modalities.

We assessed different techniques to register voxel based CBCT data with surface data obtained from laser scanning: A reference plaster cast model of a complete set of adult teeth was scanned using CBCT and laser scanning. We tested five different standard registration techniques in order to suggest the preferred techniques for maximum accuracy in alignment using the AmiraTM software. We discovered two main sources of errors: There is a system inherent difference when comparing computer modeling of CT with laser scanning and consequently when aligning them: Variations in thresholding and image resolution of CBCT data can significantly affect the final outcome. Secondly, manual alignment is a source-significant error. In contrast surface alignment provides the highest accuracy for alignment.

	MAX DISTANCE	MEAN DISTANCE	% ABOVE THRESHOLD (0.3mm)
MANUAL ALIGNMENT	0.85	0.196262	22.53%
FIDUCIAL ALIGNMENT	0.5	0.141293	9.44%
ANATOMICAL ALIGNMENT	0.55	0.10894	3.64%
VOXEL ALIGNMENT	0.52	0.0989713	2.83%
SURFACE ALIGNMENT	0.36	0.0781558	0.19%

Tab 1. Deviations measured [mm] when using 5 different standard registration techniques. % above threshold value of 0.3mm refers to the percentage of surface points that were further than 0.3mm from the reference laser surface.

P11

Double locking plate fixation of Denis II/III type sacral fractures in unstable pelvic C-type fractures – Results of 28 cases

Germann Marco, Acklin Yves Pascal, Sommer Christoph
Department of Surgery, Kantonsspital Graubünden, Chur, Switzerland

In vertical unstable AO C-type fractures with associated Denis type II/III sacral fracture, several methods exist for dorsal pelvis ring fixation. We describe a new method with dorsal double plating technique.

From 2001 to 2011, 119 unstable pelvic ring fractures were treated operatively in our institution. 28 patients suffering AO C-type fractures with associated Denis type II or III type fractures met the inclusion criteria. For osteosynthesis, a posterior median approach was used, allowing anatomic reduction of the sacral fracture under visual control. For fixation, two parallel locked compression plates (LCP 3.5) were used, placing the most lateral screws either sacral or sacro-iliacal.

All patients were assessed clinically and radiologically. For evaluation of the functional outcome, the lowa pelvis Score was used. Patients were contacted by phone after a minimal follow-up time of twelve months.

28 patients sustained a vertical unstable pelvic ring injury. Associated with the injury, eight patients showed a lumbo-sacral plexus lesion. Eighteen patients were operated in a one-stage procedure. In the perioperative period, four infections were observed but could be treated successfully without long-term sequelae. There was no iatrogenic neural injury observed. Long term follow-up was available in 24 of the 28 patients. All fractures united within the follow-up period.

The lowa pelvis Score was available for twelve patients. All patients consider their functional outcome good or excellent (average: 91.6/100 pts).

Dorsal double locking plate fixation of the sacral component by open approach and direct reduction is a successful and save alternative to percutaneous iliosacral screw fixation in pelvic C-type fractures. The risk of iatrogenic nerve injury seems to be low even in Denis II type fractures. The open approach enables a good quality of reduction especially in severely displaced fractures, which increases the postoperative stability even using small 3.5mm implants.

P12

Changes in cognitive functions after CPAP-therapy

Grubauer Andrea¹, Keller Martin¹, Kuhn Max², Kast Martin³, Kesselring Jürg¹

¹ Department of Neuropsychology, Rehabilitation Center Valens, Switzerland

² Division of Pneumology, Kantonsspital Graubünden Chur, Switzerland

³ Department of Psychology, University of Zurich, Switzerland

Obstructive sleep apnoea syndrome (OSAS) is a disorder characterized by periodic breathing with repetitive apnoeas and arousals leading to fragmented sleep. This may cause daytime somnolence and neuropsychological deficits with impairment of cognitive functions (Ferini-Strambi L. et al. 2003; Mazza S. et al. 2005). People suffering from OSAS have an increased rate for car accidents due to the occurrence of microsleep episodes (Orth, M. et al. 2005). We hypothesize that Continuous Positive Airway Pressure therapy (CPAP), shall improve attention, vigilance, verbal and figurative memory and flexibility after eight weeks of treatment. Hence we examined 52 people suffering from OSAS before and after two months of CPAP treatment in a neuropsychological assessment. Significant improvements were found in directed attention, visual memory, verbal short-term memory, response generation and fluid ability. Future research aims to examine a sample of 52 healthy individuals in order to determine whether an effect for the significant improvements are related to CPAP therapy or whether these results need be ascribed to training in the neuropsychological assessment.

P13

Circulating lymphoid tissue inducer-like cells in asthma

Komlosi Zsolt Istvan^{1,3}, Kirsch Anna², Losonczy Gyorgy³, Rückert Beate¹, Kovacs Nora¹, Van De Veen Willem¹, Akdis Cezmi Ali¹

¹ Swiss Institute of Allergy and Asthma Research (SIAF) University of Zurich, Davos, Switzerland, Christine Kühne-Center for Allergy Research, Davos Switzerland

² Hochgebirgsklinik, Davos-Wolfgang, Switzerland

³ Semmelweis University, Department of Pulmonology, Budapest, Hungary

The lung-associated lymphoid tissues are reorganized during the development of allergic asthma, as there is a Th2-biased inflammatory response to innocuous environmental antigens (allergens) in these patients instead of the default immune tolerance in healthy individuals. Lymphoid tissue-inducer cells (LTi-s) - the architects of the secondary lymphoid organs - are residing on the interface of B and T cell zones in adult lymph nodes. We investigated whether LTi-s may have a role in the pathogenesis of asthma. We isolated CD45+ CD3- CD4- CD20- CD14- CD56- IL-7Ralpha+ CD161+ c-Kit+ LTi-like cells from peripheral blood of healthy individuals and allergic asthmatic patients. Significantly lower circulating LTi-like cell counts was observed in asthma patients (363.1 ± 30.4 / mL) compared to healthy controls (773 ± 99.3 / mL), suggesting an increased demand for these cells in the lung-associated immune tissues, in asthma. Sorted LTi-like cells can be kept in cultures for up to 50 days in IL-7- and/or IL-15-enriched medium. Their proliferation can be inhibited by TGF-beta. LTi-like cells express CD40L and TLR-9; and approx. 40% of them express CCR6. LTi-like cells can regulate B cells, in vitro. In B-cell - LTi co-cultures the production of IL-13, IP-10, VEGF, IL-1alpha and especially IL-10 was increased, while IL-1beta, IL-6, IL-8 and RANTES were decreased. The pattern of immunoglobulin production by the B cells was substantially changed by LTi-s, as well. In addition, higher cell proliferation in LTi-B cell co-cultures was detected compared to B-cell or LTi alone cultures. In conclusion, LTi-like cells may play a role in the shaping of humoral immune responses and thus, in the pathogenesis of asthma.

P14

Molecular characterization of *Staphylococcus aureus* from orthopaedic device related infections

Post Virginia¹, Wahl Peter², Uckay Ilker³, Ochsner Peter⁴, Zimmerli Werner⁵, Moriarty T. Fintan¹, Richards R. Geoff¹

¹ AO Research Institute, Davos, Switzerland

² Kantonsspital Freiburg, Switzerland

³ University Hospital Geneva, Switzerland

⁴ Kantonsspital Luzern, Switzerland

⁵ Kantonsspital Liestal, Switzerland

Aim: To characterize *Staphylococcus aureus* isolated from infections associated with fracture fixation devices and to compare them with *S. aureus* from prosthetic joint infections, osteomyelitis and diabetic foot and spine infections.

Methods: *S. aureus* isolates were collected from four Swiss hospitals from patients with infections associated with fracture fixation implants (FF; n=55), prosthetic joint infections (PJI; n=56), osteomyelitis (OM; n=12), diabetic foot and spine infections (D/S; n=17). All isolates were typed by *agr* (accessory gene regulator) group, *spa*-typing, and coagulase gene typing. The most relevant virulence factors were screened for by PCR.

Results: The majority of the *S. aureus* were methicillin susceptible (MSSA) with 87.3%, 75%, 100% and 94% in groups FF, PJI, OM and D/S, respectively. All four *agr* types were present in each group except for group FF, in which *agr* IV was absent. *Spa*-type t041 was the most frequent type (18/140) and only present in groups FF and PJI. Coagulase types 2.1 (14/140) and 3.1 (24/140) were the most common ones. Type 2.1 was present in groups FF (6/55), OM (1/12) and PJI (7/56), and most isolates belonged to *agr* III. Coag type 3.1 was only present in groups FF (8/55) and PJI (16/56) that belonged mainly to *spa*-type t041 and *agr* II. There was no consistent pattern of virulence factor or MSCRAMMs possession within each group.

Conclusions: MSSA was more prevalent than MRSA in this collection. A possible trend is observed whereby coag type 3.1 is found only in infections involving implants.

P15 **Targeting the EMPD region of IgE memory B cell**

Prati Moira, Rhyner Claudio, Cramer Reto
Molecular Allergology, Swiss Institute for Allergy and Asthma Research (SIAF), Davos, Switzerland,

Background: In industrialized countries approximately 30% of the population is affected by IgE-mediated allergies, including asthma, atopic dermatitis or allergic rhinoconjunctivitis. Allergen-specific IgE is the key molecule in allergic diseases and it can be expressed either as secreted IgE (sIgE) or as membrane-bound form (mIgE), which contains two additional exons termed M1 and M2. The M1 exon codes for an extracellular membrane-proximal domain (EMPD) and for the transmembrane domain, whereas the M2 exon codes for the cytoplasmic domain expressed only in memory B cells as integral part of the B cell receptor (BCR).

Aims: We think that specific targeting of mIgE on memory B cells is a useful strategy for prophylactic therapeutic interventions. With this study we aim therefore to demonstrate that anti-EMPD mAbs can be used to isolate IgE-switched memory B cells from blood of allergic patients.

Results: One anti-murine and three anti-human hybridomas were selected for further characterization and for production and purification of the corresponding monoclonal antibodies. The mAb specific for the human EMPD domain with higher specificity and affinity ($K_D \sim 10^{-10}$), was used to sort IgE⁺ memory B cell from allergic patients' PBMC's. Usually the frequency of IgE⁺ B cells is very low. Preliminary results have shown that about 0.3 % of the total B cell can be targeted with the monoclonal hAbC20.

Conclusions: With this approach we want to generate clones producing human allergen-specific mAbs of the IgE isotype by immortalization in order to elucidate IgE-binding epitopes by co-crystallization of allergens and allergen-specific human Fab fragments. These initial studies can facilitate the discovery and development of new therapeutics, vaccines, and diagnostics, thus providing new insights into allergy-related disorders.

P16 **Bridging the gap between traditional biosensor and cell based assay**

Rhyner Claudio, Prati Moira, Garbani Mattia, Huitema Carly, Kenk Marion, Romer Katharina, Cramer Reto
Swiss Institute of Allergy and Asthma Research (SIAF), Davos, Switzerland

The homo- or heterotypic interaction of biomolecules, like for example, proteins, peptides, nucleic acids and lipids are fundamental for cellular functions on all levels, including immune responses, regulation, metabolism, signalling, cellular and tissue architecture. Elucidation of these interactions by different tools is crucial to extend our knowledge aimed at understanding cellular functions, signalling pathways, and immune responses. Moreover a deep understanding of molecular interactions is essential for the development of novel diagnostic tools, for the discovery of new target molecules, and for the development of new therapeutic strategies. Methods delivering qualitative and quantitative information on molecular interactions are isothermal titration calorimetry (ITC), atomic force microscopy (AFM), quartz-crystal microbalance (QCM), and surface plasmon resonance (SPR). The latter two are the most widespread systems used, and SPR and QCM are considered the most robust and flexible systems allowing to study molecular interactions between a very diverse set of interaction partners including antibodies, receptors, antigens, enzymes, growth factors, glycoproteins, nucleic acids, viruses and cells. IgE is the key molecule in allergic diseases and it can be expressed either as secreted IgE (sIgE) or as membrane-bound form (mIgE), which contains two additional domains termed M1 and M2. The M1 region codes for an extracellular membrane-proximal domain (EMPD) and for the transmembrane domain, whereas the M2 region codes for the cytoplasmic domain ex-

pressed only in memory B cells as integral part of the B cell receptor (BCR). Here we show the determination of binding affinities from different monoclonal antibodies to IgE, recombinant IgE fragments, and IgE expressed on the surface of murine fibroblast.

P17 **Hemiresurfacing of the shoulder: Bone remodelling and osseous integration of the implant**

Schmidutz Florian^{1,2}, Sprecher Christoph M.¹, Nehr Bass Dirk¹, Milz Stefan^{1,2}, Gohlke Frank³, Hertel Ralph⁴, Jäger Martin⁵, Südkamp Norbert P.⁵, Braunstein Volker^{1,2}

¹ AO Research Institute Davos, Davos, Switzerland

² Ludwig-Maximilians University, Munich, Germany

³ Klinikum Bad Neustadt, Germany

⁴ Lindenhofspital Bern, Switzerland

⁵ University of Freiburg, Germany

Hemi-resurfacing of the shoulder intends to restore a destructed joint with only little bone loss. The clinical short-term results of different cementless resurfacing implants have shown to be good. However, due to the radiopaque cup, little is known about the bone morphology and the osseous integration.

Eight uncemented hemi-resurfacing shoulder implants were retrieved from humans undergoing revision surgery due to glenoid failure. The collective included 2 different designs, with 4 Epoca (Synthes, CH) and 4 Copeland implants (Biomet, USA).

The bone and implant were embedded together in polymethylmethacrylate, and a section was taken through the implant centre. After Giemsa-Eosin staining and digitalisation, the relative bone density (BD [%]) under the implant and the relative bone implant contact (BIC [%]) at the interface were evaluated using the imaging software KS400 (Zeiss, Germany). Additionally, scanning electron microscopy was performed to evaluate the bone at the implant interface. Unpaired t-test was used to compare the two designs, with a $p < 0.05$ denoting significance.

Quantitative evaluation of the BD revealed a reduced bone stock below most implants, with 12.0 ± 3.8 % for the Epoca and 8.2 ± 4.9 % for the Copeland implants ($p = 0.27$). In contrast, the BIC was good, with 35.8 ± 8.3 % for the Epoca and 35.6 ± 13.7 % for the Copeland implants ($p = 0.98$). SEM and semi-quantitative histology confirmed the good osseous integration at the interface, but new bone formation was only limited and predominantly seen at the implant stems. In conclusion, both cementless shoulder resurfacing implants showed a good bone implant contact, which is suggestive for a sufficient initial stability and a good ingrowth of bone into the implant coating. However, the bone stock under the implant cup appeared to be reduced, which might be related to an unloading of the bone, similar as seen in hip resurfacing arthroplasty.

P18 **The direct anterior approach in hemiarthroplasty for displaced femoral neck fractures**

Schneider Kerstin^{1,2}, Audigé Laurent², Kuehnel Stefanie-Peggy¹, Helmy Naeder¹

¹ Department of Orthopedics and Traumatology, Bürgerspital Solothurn, Solothurn, Switzerland

² AO Clinical Investigation and Documentation, Davos, Switzerland

Hip replacement is the most common treatment for displaced femoral neck fractures in the elderly, and minimally invasive surgery is popularized in the field of orthopedic surgery. This study evaluated the outcome of monopolar hemiarthroplasty by the direct anterior approach over a postoperative period up to 2.5 years. A total of 86 patients with displaced femoral neck fractures were included (mean age of 86.5 years). Surviving patients were reviewed 3 months (retrospectively) and 1 to 2.5 years (prospectively) after surgery. One-year mortality was 36%.

For all stems, implant positioning concerning stem alignment, restoration of leg length and femoral offset was correct. Acetabular protrusion was observed in 55% of the patients 1 to 2.5 years postoperatively. Subsidence and intraoperative periprosthetic fractures occurred in 3 patients (3%) each. All revision stems for

postoperative periprosthetic fractures could be implanted using the initial surgical technique without extension of the previous approach. The mean Harris Hip Score was 85 points at the 1- to 2.5-year follow-up, 85% of the patients were satisfied with their operated hip and 57% returned to their preoperative level of mobility. Based on these findings, hemiarthroplasty for hip fractures can be performed safely and effectively via the direct anterior approach with good functional outcome and high patient satisfaction.

P19 Automatic segmentation of osseous structures in CT-angiographies

Sharma Sonam^{1,2}, Drexel Johann³, Busolt Ulrike²

¹ AO Research Institute, Davos, Switzerland;

² Department of Biomedical Engineering, Furtwangen University, Villingen-Schwenningen, Germany;

³ Fraunhofer MEVIS, Bremen, Germany

Background: Computed tomography angiography (CTA) allows an in-vivo assessment of vascular structures for diagnostic purposes. The dense osseous structures often hide the vessels during visualization. One of the existing methods for removing osseous structures is the *hierarchical watershed transform* (1). It generates an initial segmentation from inverted CTA image first, and then in a second merging stage, uses a heuristic classifier for generating markers. This allows fast segmentation of the osseous structures, but faces limitations. For example, close contact between bone and vessels usually leads to leakage, as their intensities are very similar. The algorithm is also sensitive to noise, resulting in over-segmentation. In order to avoid these limitations, smoothing of the images is needed. The *Viscous Watershed Transform* (VWT) is a technique that allows smoothing images prior to segmentation, thus preserving the original segmentation properties. The aim of this research was to implement the VWT algorithm for segmentation of 3D CTA images.

Method: We developed a morphological segmentation pipeline for applying the VWT for bone segmentation in CTA. The first half of the pipeline works on obtaining geometrical meaningful watershed basins with the viscous closing algorithm. The second part of the pipeline uses object based image analysis (OBIA) framework of MeVisLab for the basins classification. The new pipeline was evaluated on four patient's clinical 3D CTA datasets.

Results and Conclusion: The algorithm resulted in well-defined geometric watershed basins. Our patient's datasets evaluations showed that the classification of osseous structures is not possible solely based on intensity, as some times the intensities of both the vessels and bones overlaps. Hence further classification using shape descriptors are needed. Nevertheless the designed pipeline has shown more possibilities for future research.

References: (1) Hahn Horst et al. CVAMIA, 2006:178-189.

P20 Salt-sensitivity, the only cardiovascular risk factor that you can't determine, can you? The preliminary results of a pilot study

Sibalic Vladimir

Private University of the Principality of Liechtenstein

Background: Salt-sensitivity is the only cardiovascular risk factor in hypertensive individuals that cannot be tested easily. In order to develop a diagnostic test of this very complex topic, we chose a descriptive analysis of renal salt excretion in SS. A 2-hour urine sample can be used to calculate idiosyncratic modulations of fractional excretion (FE) of sodium (FENa), FE of potassium (FEK) and FE of urea nitrogen (FEUN) in SS.

Method: 19 healthy untreated hypertensive individuals without comorbidities collected a 2-hour urine in the morning after ingestion of 3 grams of NaCl-tablets and 5 deciliter of water. A venous blood sample was drawn and the FENa, the FEK and the FEUN were calculated. A one-week dietary salt deprivation and a checkerboard-pattern blood pressure (BP) home measurement defined salt-sensitive (SS) and salt-resistant (SR) patients. All FE-values of SS-patients were compared FE-values of SR-patients.

Results: If both requirements, a FEUN more than 52.9 and a FEK more than 11.5 are fulfilled simultaneously or a FEUN more than 52.9 and a FENa more than 1.2 are present at once, the specificity for SS is 78%, the positive predictive value (PPV) is 67%. The negative predictive value (NPV) is 54%. The likelihood ratio is 1.8. Discussion and Perspective: The prevalence of SS-hypertension in the study population is almost 50%. It is more than in other studies. This is because we defined SS as a statistically significant BP-reduction under a salt depleted diet, which was approximately 5%. Other studies use a 10% drop of BP. A cut-off value for SS for each FE was defined deliberately by the standard deviation value of SR patients. Although the differences of FE values in SS and SR-individuals were statistically not significant, the combined use of FE-parameters as a score could identify SS. A confirmatory population study is planned.

		N	Mean	Std. Deviation	Std. Error Mean
Salt-resistant	FENa	9	0.836	0.420	0.140
	FEK	9	8.605	2.870	0.957
	FEUN	9	41.282	11.643	3.881
Salt-sensitive	FENa	10	1.039	0.517	0.163
	FEK	10	11.903	5.137	1.624
	FEUN	10	49.993	9.781	3.093

FENa: p= 0.420 FEK: P= 0.096 FEUN: p= 0.135

P21 Experiences of multiple sclerosis affected humans with the intervention of mobility enhancement

Suter-Riederer Susanne¹, Imhof Lorenz¹, Kesselring Jürg², Mahrer-Imhof Romy¹

¹ Zürcher Hochschule für Angewandte Wissenschaften ZHAW

² Kliniken Valens, Rehabilitationszentrum Valens, Valens, Switzerland

In Switzerland approximately 10'000 people suffer from Multiple Sclerosis (MS). Patients with MS suffer from fatigue, weakness, reduced motor activity/mobility, vertigo, deterioration of coordination, sight, hearing, swallowing, thinking, excretion, and acting. Over the years, nurses have developed an intervention to enhance patients' mobility and functionality, patients' safety, body perception, kinesthetic competence, and to reduce burdens of care. This "intervention of mobility enhancement" (MfP, "Mobilitätsfördernde Pflegeintervention") has shown great promise in the care of this population. People with MS who are restricted in movements, receive the intervention during their rehabilitation stay. They sleep on a mattress on the floor and they benefit from the daily mobilizations over several steps from the ground to the wheelchair and vice versa.

The effectiveness of MfP is actually tested in a randomized controlled trial (RCT). In order to explore the lived experiences with MfP, 16 participants of the intervention group of the RCT were interviewed and their statements analysed based on interpretive phenomenology.

The participants suffered between three and 31 years from MS, the mean length of stay in the clinic was 26 days and they had MfP for max. 30 days. The participants' experiences with MfP differed depending on their personality, the trajectory of the illness and their social context. While some experienced MfP as an additional training possibility, others felt exertion. Some participants found new confidence and trust and connected with the nurses, others experienced well-being and felt a healing power. The findings offer nurses access to the world of this population and allow nurses to meet the needs of these patients better.

P22 Biomechanical evaluation of biodegradable augmentation material for traumatic vertebral compression fractures

Zderic Ivan¹, Shiozaki Yasuyuki¹, Benneker Lorin M.², Windolf Markus¹

¹ Biomedical Services, AO Research Institute, Davos, Switzerland

² Inselspital Bern, Universitätsklinik für Orthopädische Chirurgie, Bern, Switzerland

Background: The aim of this study was to investigate biomechanically the performance of human cadaveric vertebrae, reinforced with either biodegradable or standard PMMA cement.

Methods: Sixteen vertebrae (L2 to L5) were dissected from soft tissue and divided pairwise into two groups. Using a material testing system¹, the intact specimens underwent non-destructive quasi-static biomechanical tests in axial compression, torsion, lateral bending and flexion/extension. Subsequently, each vertebra was compressed axially to simulate an A1.3 fracture and tested again in all load directions. Augmentation was then performed by injecting transpedicularly 3.6 ml either PMMA³ or the biodegradable cement² into the corresponding vertebrae. Finally, all mechanical tests were repeated in augmented state. Construct stiffness was analyzed statistically¹ for all states and load directions.

Results: Vertebrae fracturing resulted in significant stiffness decrease in all load directions, compared to the intact state ($p \leq 0.006$). After augmentation, construct stiffness remained significantly lower than in the intact state ($p \leq 0.008$), considering all load directions and both cements. Compared to the fractured state, augmentation with PMMA did not significantly increase the torsion ($p = 0.083$) and flexion/extension ($p = 0.055$) stiffness, whereas augmentation with biodegradable cement did not significantly increase the bending stiffness ($p = 0.39$). For all other load directions, construct stiffness was significantly higher after augmentation compared to the fractured state ($p \leq 0.039$). Further, neither the decrease in stiffness after fracturing nor the stiffness increase after augmentation differed between the two study groups (all $p \geq 0.099$).

Conclusion: Augmentation with both cements showed a statistically significant stiffening effect of the fractured vertebra under axial compression. Injected cement volume of approximately 9 % of the vertebral body volumes was smaller than recommended [1]. This could be the reason for low stiffness improvements in some loading directions.

References: [1] Liebscher MAK, Rosenberg WS, Keaveny TM. Effects of Bone Cement Volume and Distribution on Vertebral Stiffness After Vertebroplasty. *Spine* 2001, 26

¹ Mini Bionix II 858, MTS Systems Corp., Eden Prairie, MN, USA

² Vertecem V+, Synthes GmbH, Switzerland

³ Synthes GmbH, Switzerland

⁴ SPSS for Windows, v19.0.2, SPSS Inc., Illinois, USA

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P23

ACoRE A1- Regionales regeneratives Potential oberflächennaher Geothermie

Burger Simon^{1,2}, Sitzenfrei Robert², Rauch Wolfgang²

¹ alpS, Innsbruck, Österreich

² IUT / Universität Innsbruck, Innsbruck, Österreich

Oberflächennahe Geothermie (bis 400m Tiefe) gilt als eine der erneuerbaren und damit nachhaltig nutzbaren Energien, da ihr mit dem Erdwärmestrom und der Sonneneinstrahlung – zumindest nach menschlichen Dimensionen und Zeiträumen – zwei nicht versiegende Energiequellen zur Verfügung stehen. Daraus darf man jedoch nicht schließen, dass wir dem Untergrund grenzenlos Energie entziehen oder zuführen können. Das würde nämlich bedeuten, dass wir mit der Zeit ein Temperaturniveau provozieren, welches einerseits eventuell negative Auswirkungen auf Mensch, Tier und Umwelt hat, andererseits eine weitere Nutzung des Bodens als Energiespeicher verhindert.

Um festzustellen, wie groß das regenerative Potential für die oberflächennahe Geothermie tatsächlich ist, genügt es somit nicht ausschließlich zu ermitteln wie viel Energie dem Untergrund mit modernen Systemen entnommen werden kann, sondern es ist vielmehr notwendig zu bestimmen, welche Energiemenge den oberflächennahen Bodenschichten nach einer Wärmeentnahme wieder zugeführt wird. Nur wenn ein Gleichgewicht zwischen Energieentnahme und -zufuhr herrscht ist die Bezeichnung „nachhaltig“ gerechtfertigt.

Bisherige regionale Potentialanalysen stützen sich zum größten Teil auf die Dimensionierungskennwerte aus SIA, VDI und ÖWAV (technisches Potential). Diese Werte wurden jedoch für Einzelanlagen und für die Lebensdauer einer einzelnen Anlage ermittelt. Befinden sich in einer Region mehrere Anlagen und sollen diese nachhaltig genutzt werden, kann gezeigt werden, dass das Potential dafür mit bisherigen Methoden überschätzt wurde. Dies

ist auf die Vernachlässigung der gegenseitigen Beeinflussung der Geothermieanlagen und die limitierte Betrachtungszeit zurückzuführen.

In dieser Arbeit wird mittels Analysen in einem Geoinformationssystem (GIS) das regenerative Potential für die Modellregion Tirol ermittelt. Anhand der Ergebnisse kann gezeigt werden, wie groß der Unterschied zwischen dem technisch nutzbaren und dem regenerativen oberflächennahen Potential tatsächlich ist (im schlechtesten Fall nur ca. 1:100). Die Bestimmung eines regenerativen und nachhaltig nutzbaren Potentials als Obergrenze für die technisch mögliche Entzugsleistung stellt eine neue Betrachtungsweise dar, die die Nutzung der Geothermie auch für zukünftige Generationen sichert.

P24

Solar activity and climate forcing

Cessateur Gaël¹, Shapiro Alexander¹, Schmutz Werner¹, Tagirov Rinat^{1,2}

¹ Physikalisch-Meteorologisches Observatorium Davos / World Radiation Centre, Davos, Switzerland

² ETHZ, Zurich, Switzerland

The main energy input to the terrestrial environment comes from solar radiation. The Sun varies on all times scales and its variability is strongly wavelength-dependent. For instance, the variability on a 27-day solar rotation scale, for example, is mostly related to the appearance and disappearance of active regions at the solar surface. Long-term variations, such as the solar cycle modulation of about 10-12 years, also have a more marked impact on the shorter wavelengths. At the same time, the mechanisms by which the solar irradiance and its variability might affect the various layers of the terrestrial atmosphere are still poorly known. Various space weather applications, such as orbit determination, satellite communications, and positioning require a continuous and radio-metrically calibrated monitoring of the solar spectral irradiance in the UltraViolet (UV). In this presentation, we will first briefly review the main mechanisms by which solar variability affects the Earth but also others planets.

The long-term monitoring of the solar irradiance, however, is a major challenge. Measurements must mostly be carried out in space, where current instruments suffer from ageing, degradation, and signal contamination. We will then review the past, present, and future instruments dedicated to the observation of the solar irradiance, which is one of the main tasks of the PMOD. The on-going PICARD mission gives us today valuable information over the whole solar spectrum which helps us to better understand the solar variability. Some interesting comparisons between modeling and measurements will be presented.

P25

Stopping behaviour of snow avalanches in forests

Feistl Thomas, Bebi Peter, Bühler Yves, Christen Marc, Bartelt Perry

WSL Institut für Schnee- und Lawinenforschung SLF, Davos, Switzerland

A longstanding problem in avalanche science is to understand how forests stop small and medium sized avalanches. Avalanche dynamics models have traditionally been employed to calculate extreme avalanche run-out and have assigned a minor role to forests in dissipating flow energy. In this paper we quantify the important effect of forests in stopping small avalanche events, crucial for road and ski-run safety. Therefore we performed field studies of several avalanches where trees affected the run-out. We gathered information concerning the starting location, deposition heights, run-out distance and forest structure. These studies were made during the 2012 winter where many gliding snow avalanches released in forested areas in Switzerland and Germany. We also have additional data from the forest avalanche database of the SLF. Using the field observations as a guide, we hypothesized that mass detrainment due to tree-avalanche interaction led to a significant deceleration of the avalanches. This effect is important for physics based avalanche dynamics models which reveal that avalanche

mobility is strongly linked to mass entrainment/detrainment. We simulated the avalanche events using such a model to demonstrate the breaking effects of forests. Furthermore, numerical investigations using well-defined terrain configurations were performed. These highlight how forests influence mass and energy fluxes at the front and sides of the avalanches. Of particular importance is the distribution of velocity across the flow width of the avalanche, as flow mass can be easily stopped. We provide suggestions how to characterize forests in avalanche dynamics models.

P26

Angle interrogating optical sensor ARGOS: Scanning MEMS mirror for waveguide grating based label-free monitoring of toxins and pollutants

Kehl Florian^{1,2}, Follonier Stéphane¹, Vörös János²

¹ Centre Suisse d'Electronique et de Microtechnique, Landquart Center, Switzerland

² Laboratory of Biosensors and Bioelectronics LBB, ETH Zürich, Switzerland

Endocrine disrupting compounds (EDCs) pose a significant threat to the environment and human health. They are chemicals that can mimic natural hormones or inhibit their action by interacting with the receptors of natural hormones, thus altering the normal function of the endocrine, immune or nervous systems. In aquatic environment, all organisms are continuously exposed to EDCs for several life generations since most of them are persistent pollutants. Aquatic organisms have proteins capable of binding EDCs. Such proteins are ideal candidates as biological recognition elements for biosensors, since they will bind any EDC present in the analyzed sample.

Here we present a novel waveguide grating based approach by employing microelectromechanical (MEMS) elements to monitor binding events of EDCs and toxins, using abovementioned aquatic biomolecules as signal transducers. We propose a biosensor platform for remote surveillance of EDCs, capable of monitoring the presence of toxins and pollutants in potable water as well as the aquatic environment.

The label-free optical biosensor system ARGOS (Angle interrogating optical sensor) relies on a MEMS micromirror device to interrogate waveguide grating sensing regions on an optical transducer chip by scanning the angle of the incident coherent light, resulting in the determination of effective refractive-index changes on a chemically functionalized interface at a high acquisition rate. The tunable MEMS mirror allows interrogating a wide dynamic range and hence offers the flexibility to investigate at the point of interest. The optical reader development is part of the European FP7 Project RADAR (Rationally Designed Aquatic Receptors integrated in label-free biosensor platforms for remote surveillance of toxins and pollutants).

P27

Differentiation of flow components using the end-member mixing analysis (EMMA) in the Brixenbachtal catchment, Tyrol

Kerl Florian¹, Meißl Gertraud¹, Schneider Katrin²

¹ Institute of Geography, University of Innsbruck, Innsbruck, Austria

² alpS GmbH, Innsbruck, Austria

Tracerhydrology is a method for getting a better understanding of run-off generation and flow processes in hydrological systems. A tracer can be either geogenic, like silica or ¹⁸O, or artificial, like fluorescent substances. The method is generally used for tracing the way of water within a basin. Investigating end-members (i.e. run-off sources) of the hydrological system is a part of the convergence approach from Leibundgut (1987). The end-member mixing analysis (EMMA) of Kendall and McDonnell (1998) was developed for separating water sources through mass balance equations. In this study EMMA is used to detect discharge source areas and to separate event- and pre-event water with the two-component hydrograph separation technique. The study area, the Brixenbachtal catchment, is located in the North-Tyrolean Greywacke Zone in the Kitzbühler Alps, Tyrol. Using the different geology of the sub-

basins in the Brixenbachtal catchment, the contribution of each sub-basin to the discharge is analysed. Dissolved silica as geogenic tracer and in addition electric conductivity and temperature as physical characteristics will be observed. Electric conductivity and the concentration of silica are expected to be highest in the pre-event water due to long contact times between water and minerals. The event water is assumed to have very low silica concentration and electric conductivity. Groundwater inflow is characterized by a decreasing temperature and a change of electric conductivity in the stream water. Within this master thesis the following research questions will be assessed: (a) Is it possible to detect the source areas (with respect to their different lithologic characteristics) of the run-off using this tracer combination? (b) Is it possible to do a two-component hydrograph separation with this tracer combination? (c) Is there a difference between the tracer signals of dissolved silica and electric conductivity? Can those two tracers be substituted?

P28

Plasmacytoid dendritic cells induce Foxp3 regulatory T cells in response to *Bifidobacterium infantis*

Konieczna Patrycja, Ziegler Mario, Frei Remo, Ferstl Ruth, O'Mahony Liam

Swiss Institute of Allergy and Asthma Research (SIAF), University of Zurich, Davos, Switzerland

The commensal microbiota is required for optimal immune development and for ongoing intestinal homeostasis, which involves an inter-dependence between microbes and immunity. *Bifidobacterium infantis* is a commensal bacterium which has been previously shown to protect against inflammatory diseases in murine models, e.g. colitis and respiratory allergy. The protective host immune response in murine models was demonstrated to include the induction of T regulatory cells. However, the molecular basis for the Foxp3 regulatory T cells induction by specific microbes is poorly understood. The aims of this study are: (1) To evaluate the plasmacytoid dendritic cell response to *Bifidobacterium infantis*; (2) To determine the effect of activated plasmacytoid dendritic cells on naive T cell priming. Firstly, plasmacytoid dendritic cells were stimulated with bacteria and cytokine secretion was measured by luminex. Moreover gene expression was quantified using qRT-PCR. Pattern recognition receptors were blocked using antibodies or oligonucleotides. Bacterial binding was visualized using multispectral flow cytometric imaging. *Bifidobacterium infantis* stimulated plasmacytoid dendritic cells expressed IL-10 and indoleamine 2, 3-dioxygenase (IDO), with low levels of IL-12p70 and IFN-alpha. The cytokine response was TLR-9, but not TLR-2, dependent. Bacterial activated plasmacytoid dendritic cells were cultured with autologous CD4+ T cells and Foxp3 expression was analysed by flow cytometry. Co-culture of naïve T cells with bacterial primed plasmacytoid dendritic cells resulted in enhanced expression of Foxp3 in CD4+CD25+ cells. Inhibition of IDO activity with 1-methyl-tryptophan blocked induction of T regulatory cells. These results demonstrate that *Bifidobacterium infantis*-stimulated plasmacytoid dendritic cells induce an immunoregulatory response, suggesting that this microbe may have therapeutic utility in patients with inflammatory disease.

P29

Electrochemical microsensors for monitoring the functions of liver cells in a modular based microfluidic system

Larsen Jakob Bonne^{1,2}, Barbe Laurent¹, Generelli Silvia¹, Guenat Olivier^{1,2}

¹ Centre Suisse d'Electronique et de Microtechnique, Nanomedicine, Landquart, Switzerland

² University of Bern, ARTORG Center, Bern, Switzerland

European legislation is restricting the use of animals for toxicological studies, which increases the need for alternative testing methods. The HEMIBIO project aims at developing a hepatic 3D microbioreactor reproducing the complexity of the liver for pre-clinical toxicity testing. One of the major challenges in building a 3D-liver bioreactor is the lack of data on the complex environ-

ment present inside the bioreactor where the cells live, aggregate and differentiate. Most of the time, physiological samples are aliquoted to determine hepatic functions and metabolism, which is an inaccurate, time-consuming and often destructive process, in particular when the sample volumes are small. Under these circumstances, microsensors located in the direct vicinity of the cells can play a vital role, by monitoring cell culture conditions and thus help mimic the natural microenvironment.

In order to simplify the overall structure of the microbioreactor, independent modules for cell culture and sensing will be integrated. Our specific objective is to develop one of the microsensor modules that will integrate an alanin-aminotransferase (ALT), a urea and a NH₄⁺ electrochemical microsensor. These microsensors will be interrogated at specific times (for instance after a toxic insult) and will provide crucial information related to the current cell conditions. The modular concept will not only allow for replacement of faulty sensors during cell cultivation if needed, but also to implement additional sensors able to discriminate the specific patterns of liver injury (cholestasis, steatosis). ALT, urea and NH₄⁺ have been chosen as highly specific markers of liver cell metabolism.

P30

Improving hourly precipitation estimation to model water budget in alpine catchments

Mair Elisabeth¹, Bertoldi Giacomo¹, Della Chiesa Stefano^{1,2}, Niedrist Georg^{1,2}, Tasser Erich^{1,2}, Tappeiner Ulrike^{1,2}

¹ Institute for Alpine Environment, European Academy of Bozen/Bolzano (EURAC), Bozen, Italy

² Institute of Ecology, University of Innsbruck, Innsbruck, Austria

Quantifying the water budget in Alpine catchments is crucial in order to evaluate their potential in terms of water resources and the possible threats related to climate change. However, accurate quantification of precipitation is still one of the major sources of uncertainty in quantifying the water budget of Alpine catchments. Although data availability increases, usually most of the meteorological stations are located in the bottom of the valleys, whereas at slopes or at high elevation the number of measurement devices and their accuracy is limited by accessibility, energy supply, financial costs and wind influence. Furthermore lapse rates of temperature and precipitation depend on region, topography, season, and weather condition.

In this contribution we present an empirical approach to improve precipitation estimates at hourly timescales. Snow water equivalent is calculated by using snow height, standard meteorological data and metadata. The wet bulb temperature is used to distinguish between snowfall and rainfall events.

Precipitation data series obtained from unheated rain gauges are corrected by adding snow water equivalent data.

Such corrected precipitation is used as input for hydrological models allowing an improved quantification of the different water balance components (i.e. precipitation, snow melt, soil moisture, evapotranspiration, and runoff).

Results show how it is crucial to include the information on snow water equivalent as well as precipitation and temperature lapse rates coming from high elevation stations in order to (i) calculate the water balance and (ii) correctly predict the amount and the seasonality of runoff production in Alpine catchments.

The study area chosen was the dry inner Alpine Matsch Valley (100 km², elevation range from 920 to 3.738 m a.s.l.) in South Tyrol, Italy, where the EURAC Institute for Alpine Environment is leading a wide range of experimental and modeling activities in the fields of ecology and hydrology.

P31

Monitoring snow from space in the Alps: A study on snowpack parameters retrieval

Pasolli Luca¹, Callegari Mattia¹, Notarnicola Claudia¹, Bruzzone Lorenzo², Zebisch Marc¹

¹ Institute for Applied Remote Sensing, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

² Department of Information Engineering and Computer Science, University of Trento, Trento, Italy

Snow represents a central component of the Alpine environment and plays a crucial role in the water cycle and the climate system. Mapping and monitoring snow parameters (e.g. extent, wetness and water equivalent) is of utmost importance for water resource management and flood/avalanche risk assessment. To this aim, satellite remote sensing constitutes an efficient and effective tool. The potential of remote sensing for snow coverage mapping and monitoring with both optical and microwave sensors is well established also in the challenging Alpine environment and operational products are available nowadays. On the contrary, the retrieval from satellite imagery of parameters related with the snowpack, such as its density and water equivalent is still under investigation, partly due to the complexity and non-linearity of the retrieval process and partly because of technological limitations. The availability in the last few years of new generation satellite sensors, such as the X band synthetic aperture radar (SAR) systems, offer the potential for expanding this frontier. Indeed, such systems acquire signals more sensitive to water and ice particles within the snow, thanks to the higher operational frequency with respect to the sensors available in the past.

This work inserts in this framework and presents a study on the retrieval of snowpack parameters from new generation Cosmo-SkyMed X band SAR imagery in the challenging Alpine environment. In this study, an innovative algorithm for addressing the retrieval problem is developed, which is based on the integration of X band SAR signals with the information derived from optical/thermal satellite imagery and ancillary data. This approach represents an effective strategy for improving the monitoring potential of satellite remote sensing systems available nowadays. The promising results obtained in two test areas in South Tyrol during the winter 2010/2011 will be presented and discussed along with possible future developments of this research activity.

P32

Statistical model for the correlation length of snow derived from Snow-Micro-Pen measurements

Proksch Martin, Loewe Henning, Schneebeli Martin

WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

The Snow-Micro-Pen (SMP) allows retrieving various mechanical parameters from the snowpack. However, remote sensing applications rely on structural parameters of snow such as the correlation length. In the absence of a sound physical connection between structural and mechanical parameters we derive a statistical model for the correlation length from SMP measurements. To this end we have analyzed 22 snow samples of various snow types by computer tomography (CT) and SMP. We correlate the SMP-derived structural element length with the CT-derived correlation length. For validation we employ the statistical model to estimate the specific surface area from combined SMP and density measurement from natural snow profiles. We compare this SSA estimate to independent SSA measurements by Near-Infrared-Photography and discuss potentials and limitations of the method.

P33

Biomassen-Kartierung der Vegetation im Val Trupchun mit APEX Bildspektrometer Daten

Rapp Maja^{1,2}

¹ Bereich Forschung und Geoinformation, Schweizerischer Nationalpark, Zernez, Schweiz

² UNIGIS MSc, Universität Salzburg, Österreich

Im Jahr 2010 wurde das Gebiet des Schweizerischen Nationalparks (SNP) erstmals mit einer hochauflösenden Hyperspektralkamera befliegen. Es handelt sich um den APEX-Sensor (Airborne Prism Experiment) welcher hohe Qualität an Fernerkundungsdaten bereitstellt. Die hohe spektrale Auflösung ermöglicht es, die gemessenen Reflektionswerte mit der chemischen Zusammensetzung des Ausgangsmaterials zu korrelieren. Durch hohe räumliche Auflösung (2–3 Meter) eignen sich die APEX-Daten sehr gut, die chemischen Charakteristika von Vegetation flächendeckend zu kartieren.

Im Rahmen dieser Masterarbeit der Universität Salzburg und in Zusammenarbeit mit dem RSL der Universität Zürich, deren Mitarbeiter die Daten korrigiert bereitgestellt haben, wird der Biomassegehalt der Wiesengesellschaften der Val Trupchun kartiert und untersucht. Um die Aufnahmen mit den bekannten Vegetationseinheiten korrelieren zu können, wurden mehrere Plots bestimmt, von welchen Vegetationsproben am Tag des Fluges gesammelt wurden. Für das Modell werden die GPS-Koordinaten der Plots mit den Pixel des Bildes überlagert, um das Reflektionsspektrum mit den bekannten Werten zu korrelieren. Aus den APEX-Reflektionswerten wird die unbekannte Variable „Biomasse“ über einen statistischen Ansatz berechnet. Verschiedene bekannte Indizes aus der Literatur werden dabei angewendet und mit den Daten aus den Proben korreliert (z.B. NDVI). Als bester Ansatz stellte sich eine Simpel Ratio Methode zwischen zwei Bändern im Bereich von 650–800 nm mit einer Korrelation von ca. 0.7 heraus. Mit dieser Methode wird die Karte erstellt, indem die Biomasse über die Korrelation auf die unbekannt Flächen extrapoliert wird. Das Resultat zeigt Werte für den Biomassegehalt des Graslandes zwischen 0–650 g Trockengewicht pro m².

P34

The influence of near-surface warming on slab stiffness and crack propagation propensity

Reuter Benjamin, Schweizer Jürg

WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland

Near-surface warming by either an increase in air temperature or radiation is believed to have a significant effect on dry-snow slab avalanche formation. However, it is unclear how and to which degree warming promotes instability. We have therefore quantified surface warming with respect to the contributing meteorological processes and investigated in situ the fracture behaviour under conditions of surface warming. The relevant energy fluxes at the snow surface were partly measured and partly modelled with the snow cover model SNOWPACK and used to determine the energy input into the snowpack. To determine the effect of surface warming on slab properties, we derived the stiffness of snow layers from penetration resistance measurements on nine field days with the snow micro-penetrator. On eight of these days, propagation saw test experiments were performed at the same time and compared to the energy input at the snow surface. Moreover, the specific fracture energy of the weak layer, which in combination with the slab properties controls crack propagation propensity, was determined by means of finite element modelling. A reduction in stiffness by a factor of about 2 was observed in near-surface snow layers when the energy input at the surface exceeded 300 kJ m². Meanwhile, weak layer properties did not change. Softer slabs were found to cause shorter cut lengths in propagation saw test experiments – suggesting that surface warming increases crack propagation propensity. For the first time the effect of surface warming on instability has been quantified. The results demonstrate a subtle influence of surface warming on snowpack stability. It is suggested that a pre-existing weakness and significant energy input are required that surface warming may promote instability.

P35

Warning and alarm systems for natural hazards – A classification and generic system break-down

Sättele Martina, Bründl Michael

WSL Institut für Schnee- und Lawinenforschung SLF, Davos, Switzerland

Economic damage caused by natural hazards has been constantly increasing due to the ongoing climate change. This led to intensified efforts to establish warning and alarm systems as efficient components to the integrated risk management for natural hazards. During the last decades warning and alarm systems have been installed according to different needs with little degree of standardisation. A comprehensive overview of warning and alarm systems does not exist. This paper aims to identify relevant hazard

processes in Switzerland in need of warning and alarm systems, it summarises system relevant process knowledge and provides a structured overview of currently operated systems. The systems are classified according to criteria relevant for reliability prediction: The lead-time and geographical range, in addition to human and environmental factors. All systems identified have been documented according to pre-defined functional charts to derive a generic and functional break-down of the systems structure which is applicable to all kinds of warning and alarm systems for natural hazards. This generic and functional break-down structure includes units for monitoring, data management, information dissemination, power supply and diagnosis. The sub-components to the break-down form the basis for the next step. They allow the development of a method which quantifies the overall reliability of warning and alarm systems by extrapolating the reliability of manageable sub-components and finally the incorporation of warning and alarm systems as fixed components in the integrated risk management for natural hazards.

P36

The middle atmosphere response to the short-term solar irradiance variability

Shapiro Anna¹, Rozanov Eugene^{1,2}, Shapiro Alexander¹, Egorova Tatiana¹, Schmutz Werner¹, Peter Thomas²

¹ Physikalisch-Meteorologisches Observatorium Davos / World Radiation Centre, Davos Dorf, Switzerland

² ETHZ, Zurich, Switzerland

Solar radiation, which is the main energy source in the terrestrial atmosphere, is highly variable especially at the ultraviolet (UV) region of the solar spectrum. The variations of the Spectral Solar Irradiance (SSI) may substantially affect chemical and physical processes in the atmosphere. The SSI is variable on the different time scales. Using recent observations and chemistry-climate models we analyzed the response of the Earth middle atmosphere to the 27-day solar irradiance variability. We studied the response of the mesospheric water vapor (H₂O) and hydroxyl radical (OH) observed by Aura Microwave Limb Sounder (MLS). OH is produced by H₂O photolysis and modeled results showed strong response of both these species to the solar irradiance variability. The H₂O response was confirmed by observations while the OH responses to the short-term solar variability were studied only with models. We have found that the mesospheric MLS OH and H₂O show 27-day changes. We have analyzed the connection between these changes for 2004–2005 (the solar active period) and for 2008–2009 (solar minimum) and found that OH and H₂O do not correlate with the solar irradiance during the solar minimum. So we can conclude that the 27-day solar cycles in OH, H₂O and solar irradiance are physically connected. Thus we found for the first time that OH correlates with the solar irradiance. The highest correlation reaches at 76–82 km and equals 0.79. The correlation coefficient for H₂O is about -0.79.

P37

A new heliostat at PMOD/WRC

Suter Markus, Finsterle Wolfgang

Physikalisch-Meteorologisches Observatorium Davos / World Radiation Centre, Davos Dorf, Switzerland

A heliostat is an instrument that feeds light from the sun into a laboratory or a fixed telescope. As part of the renovation of the institute, the old heliostat system has been removed from the roof. The old system allowed sunlight to enter the clean room where it was mainly used to test instrument functionality. A new heliostat is planned that will have an improved light beam optical quality allowing the beam to be used for scientific laboratory experiments, while keeping the functionality of supplying the clean room with a light beam.

The heliostat will serve as a high quality light source that is needed for the laboratory characterisation of PMOD's new solar absolute radiometers CSAR and DARA. It will also allow stray light effects in older PMO6 radiometers to be further investigated. These effects have been identified as a strong source of uncertainty in the characterisation of PMO6 radiometers.

The Heliostat consists of two flat mirrors. The primary mirror is the tracking mirror that is movable in two axes. The mount is designed to avoid singularities in the mirror coordinates and to have almost continuous movement in both axes. The diameter of the heliostat mirrors are 650 mm, and the thickness is 100 mm. The mirrors are made of Zerodur, a ceramic glass, with no thermal expansion. The weight of a mirror is about 80 kg. The front surface mirrors will be coated with aluminium and a protective layer. The flatness requirements are very high in order to guarantee a high quality beam profile. It is necessary to support the mirrors in a way that no unintended bending of the mirrors due to self-gravity occurs. While the secondary mirror will be polished to compensate for self-gravity deformation, the primary mirror will be supported in a way to avoid self-gravity deformation.

P38

Analysis of solar eclipses observed by PREMOS/PICARD

Tagirov Rinat^{1,2}, Shapiro Alexander¹, Schmutz Werner¹, Cessateur Gaet¹, Thuillier Gerard³

¹ Physikalisches-Meteorologisches Observatorium Davos / World Radiation Centre, Davos Dorf, Switzerland

² ETHZ, Zurich, Switzerland

³ CNRS, Verrieres Le Buisson, France

The PREMOS instrument onboard the PICARD mission comprises two experiments. One is observing solar irradiance in five spectral channels (two UV, one visible, and two near infrared) with filter radiometers, the other is measuring the total solar irradiance with absolute radiometers. We analyze light curves of recent solar eclipses measured by PREMOS.

During eclipses different parts of the Sun are consecutively covered by the Moon. Hence light curves of eclipses can be used to accurately retrieve center-to-limb variations of the solar brightness (CLV). The formation height of solar radiation depends on the observing angle and wavelength. Therefore CLV retrieved from measurements in different spectral channels provides important information about a broad range of heights in the solar atmosphere and is valuable for adjusting and refining radiative transfer models.

PREMOS has observed three solar eclipses (June 1, 2011; July 1, 2011; November 25, 2011) up to now. We employ the radiative transfer Code for Solar Irradiance (COSI) to model the CLV and the light curves of these eclipses. Detailed analysis of the discrepancies between the theoretical and the observed light curves in all PREMOS channels allows us to constrain and improve existing semi-empirical 1-D models of the solar atmosphere.

P39

Companion preferences and social behaviour of Alpine ibex (*Capra ibex*) during the rut

Tettamanti Federico^{1,2}

¹ Department of Ecology and Evolution, University of Lausanne, Lausanne, Switzerland

² Department of Zoology and Evolutionary Genetics, University of Sassari, Sassari, Italy

We investigated the social organization in Alpine ibex, analysing the association between different age/sex classes and the effect of this aggregation on the group behaviour during the rut. Alpine ibex (*Capra ibex*) form similar age and sex groups throughout the year, except during the rut due to the decrease of sexual segregation. The groups' social organization and association index was analysed using data from 14 years of censuses (1997–2010) and group time budget using data recorded during the rut in 2009–2010. The association index represents the time spent by two different age/sex classes together. The main social organization unit found during the rut was mixed groups, where females accepted association from males' classes. However, females preferably spent more time with males 7 to 10 years old. During the rut both initiator and recipient of association affected the association index. Conversely during the pre rut period only the initiator had an influence on the index. Thus, during the rut, associations were consensual by both initiator and recipient and strongly influenced

the social behaviour of the groups. Males increased agonistic behaviour with increasing group size. In addition, the increasing of sex ratio (total number of males/total number of females present in a group) increased the energetic costly behaviour of individuals in the group. Thus, these results suggest that association is not random during the mating season and has important effects on social behaviour of individuals and groups.

P40

Access2Mountain – Sustainable mobility and tourism in sensitive areas of the Alps and the Carpathians

Weiß Miriam

Institute for Regional Development and Location Management, European Academy of Bozen/Bolzano (EURAC), Bolzano, Italy

The South-East Europe project Access2Mountain (2011–2014) aims to achieve durable, environmentally friendly tourism, as well as to ensure accessibility and connection to, between, and in sensitive regions of the Alps and the Carpathians. The collection of good practices on multimodal transport, task of the EURAC-Institute for Regional Development and Location Management, aims to serve as a source of inspiration and a decision-making tool for stakeholders involved in tourism development to determine which mobility and/or tourist activity is the right one for them. About sixty good practices from various regions have been grouped in six categories providing examples on accessibility of nature parks or ski resorts, traffic solutions for highly frequented mountain/hiking destinations, bike-and-bus packages, and on-demand bus services.

The most interesting aspect of EURAC's work is determining a good practice's transferability from one territorial context and differing framework conditions to another, for example, from the Alps to the Carpathians. First conclusions on how to do this are represented by a set of factors contributing to increase a project's successful implementation and operation. Essential is, for example, to have a professional project planning, to motivate and commit important stakeholders, to carry out accompanying marketing activities and to cooperate with and provide information to tourist information centers, and so on.

P41

Melt water run-off estimations from snow pack and soil for improved flood risk forecasts

Wever Nander

WSL-Institut für Schnee- und Lawinenforschung SLF, Davos, Switzerland

An important process for predicting flood risks is the interaction between a snow cover and the soil. The timing of snow melt and successive melt water run-off is determined by the capacity of the snow cover to retain melt water and rain. Also the soil moisture plays a role, as it determines the capacity of the soil to store snow melt water leaving the snow pack. Within the IRKIS project, the operational use of the physical based SNOWPACK model, which is used to assess the snow pack development at about 200 high alpine weather stations (IMIS), is improved to be used for flood risk assessment in summer in the Canton of Grisons. To improve the model performance with respect to the interactions between the snow cover and the soil, the SNOWPACK model has been extended with a module solving the matrix flow in both the snow pack and the soil. The model results have been validated against lysimeter measurements for snow pack base run-off at the Weissfluhjoch in Davos, and soil moisture measurement in the Davos landscape. It will be shown that the new module improves the modelling capabilities of the timing and amount of the snow pack melt water run-off. The model also helps to understand processes that are important for flood risk assessment. An example will be shown where a heavy snow fall, followed by intense rainfall, caused flooding in some parts of Switzerland in October 2011. The complex interaction between rain fall, the snow pack and the soil can be better understood with the new module.

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